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PREFACE.

The achievements in every department of thought and activity constantly grow more marvelous and astonishing. Messages are flashed hundreds of miles without electric wires. Men travel in the air and guide their ships as if they were vessels in the water. Submarine boats dive into the sea and remain many hours below the surface. The X-rays that created world-wide interest when first discovered are now overshadowed by even greater wonders, yet they are serving beneficent purposes in medical science. Discoveries in the world of invention crowd fast upon each other. We are living in the golden age of the world's history.

Appalling disasters such as floods, volcanic eruptions, earthquakes and conflagrations have shocked humanity, while dastardly deeds of violence, striking down the rulers of nations, have created consternation. On the other hand, we see magnificent progress in the arts of peace, in the development of our country's vast resources, and in every branch of science.

The grand work here described gathers into a dazzling constellation all the splendid achievements and thrilling deeds, all the great discoveries in science and all the triumphs of genius, that have crowned the centuries with fame and glory. The greatest cities, buildings, railroads, bridges, tunnels, canals, parks, mountains, volcanoes, rivers, waterfalls, feats of engineering, libraries, educational institutions, and valuable statistics are all fully treated and described.

Everything that excites curiosity and admiration is vividly depicted. The graphic stories of famous explorations and discoveries in strange lands are told with masterly effect. The greatest battles and victories; calamities resulting in great destruction of life; dastardly assassinations; greatest frauds and criminal trials; deposits of diamonds, gold and other precious metals; statues, paintings, and other celebrated works of art; in short, all that is grandest and most remarkable in the whole world, past and present, is portrayed here with resistless fascination.

The scope, character, and value of the subjects treated in this volume show the grand results that have dazzled the world in every department of human effort. These subjects embrace the sciences in their numerous divisions and conquests; arts and literature; industrial, commercial, and financial progress; land and sea prowess; educational, social, moral, and religious growth; in fact, every field of enterprise and achievement.

A volume of such variety of subjects and great extent affords a fine opportunity for illustrations. The publishers have taken advantage of this, and have beautified it in a manner which commends itself to every eye. Rarely has a volume been so elegantly embellished.

As to its aim and scope, its vigor and variety of style and thought, its historic comprehensiveness and exactness, its great wealth of illustration, its superb workmanship, and its various other striking features, the volume may readily rank as a splendid triumph, a wonder of industrious preparation, and acceptable to all.

Not only is the work a rare and costly picture, filled in with inspiring details by master hands, but it is equally a monument, with solid base, grand proportions and elegant finish. Its every subject is a glowing tribute to human achievement of every kind, wherever the field of action may lie.

With this work in the house there is but little need for more books, as far as works of reference are concerned, for this vast store-house of valuable information includes all subjects of interest to intelligent people. So popular and interesting are the subjects treated, that every page possesses a charm for all alike—the man, the child, the casual reader or the profound scholar. Thus this book is a Home Library that affords both pleasure and instruction, being a most valuable self-educator.

While due regard in the preparation of this work has been paid to the greatest records of history, it was resolved that the book should be fully up to date. This aim has been kept steadily in view. The old and worn out has had to give place to the new. In this respect the object has been so successfully accomplished as to leave nothing to be desired.

What is of greatest interest to intelligent readers, whatever is latest, newest and best in all the realms of science, invention and discovery, is here placed in vivid array before the eyes of the reader, thus furnishing an unrivaled work that will be prized in every home where it is permitted to shed its brilliant light. The grand achievements of our own time, the triumphs of genius that read like miracles—these are gathered into a golden treasury of knowledge and information, for the delight and instruction of the reading public.

The accuracy, thoroughness, wide scope and superior merits of the work will be apparent at a glance to all who examine its charming pages.

	PAGE
Elevator for Lifting and Lowering Boats	158
Inventor of the Grossman Shoe Walking on the Water	159
White Ants and Their Dwellings	162
Indian Elephant Taking Home Fodder	165
Elephants of Burmah, India, Laying Timber	166
Female Elephant Protecting Her Young	168
Bird's Eye View of the Two Great Dams on the River Nile	170
The Kidnapped Missionaries Meeting Their Rescuers	172
Madam Tsilka Meeting Her Husband	173
Healing Malignant Growths by Rays of the Sun	183
Marvelous Leap of the Diving Stag	185
Statue of Rochambeau, Washington, D. C.	194
Terrapin Rock and Horseshoe Fall in Winter	199
Ice Formation at Niagara Falls	200
Mrs. Taylor in the Barrel	202
An Artist Who Paints with His Mouth	207
Preparing Edible Turtles for the Table	209
Emperor of Japan and His Family	212
Spraying Liquid Air	216
Filling a Receptacle with Liquid Air	217
Pouring Liquid Air From a Spoon	219
Novel Dry-Dock and Submarine Workshop	221
Mammoth Tree, California	226
Stump of a Monster Tree of the Sierras	230
Breakwater and Interior Cove for the Safety of Ships	232
Tarpon Fishing in a Florida River	235
Diagram of the Yacht Race	237
Diagram of Racing Yacht	238
Cup of All Nations, Won by the "America"	240
Only Ostrich Driven in a Harness	249
First Woman President of a Telephone Company	251
Hudson Bay Trappers	255
Mode of Conveying Travelers in Guatemala	257
Escaping from the Wrecked Vessel	260
Crew and Passengers Abandoning the Wreck	261
Steamship "Oceanic" Compared with Buildings	265
Size of the "Oceanic"	266
Locomotives It Would Take to Move the Largest Steamship	267
Climbing the Matterhorn—A Plunge to Death	271
Railway up the Rigi	279
Weather Station on a Mountain Summit	280
A Caravan in East Africa Carrying Ivory	282
Great Bronze Cannon	287
Armored Submarine Torpedo, "Monitor"	289
Type of Submarine Torpedo Boat	290
Great Battleship "Kaiser Frederick III"	292
Sailing-Sledges on the Grand Canal, China	294
Stilt-Jumping—A Chinese Pastime	297
French Postman Making His Rounds on Stilts	298
Armored Car used in the South African War	306
Rattlesnake Flag	312
Flag and Shield	313

	PAGE
The Confederate Flag	314
Unite or Die Flag	315
Five World-Renowned Inventors	322
Iron-Rolling Mill	334
Tunnel Under the Hudson River	339
A Rotary Snow Plow	341
Wishing Chair at Giants' Causeway	345
Broad Band of Pastry Biscuit	347
Foremost Discoverer in the Antarctic Continent	350
Expedition in Search of the South Pole	351
Remarkable Feat of Acrobats	354
Group of Trained Athletes	356
Train Coming out of Tunnel	363
The Bowery, New York City	370
Collett's Elevated Railways	371
Exhibition of a Fire Engine	372
New Firemen's Dress	374
Locomotives Drawing a Battleship over a Viaduct	380
Views in Thibet	382
Kauffman Trick Bicyclists	389
The Kaufmans' Wonderful Feat	389
Cycling on an Inclined Track	390
Quadricycle—1776	391
Celeripede—1816	391
Draisine—1816	391
Hobbyhorse—1821	392
Lallement's Velocipede—1866	393
The Cycle in Use on the Water	393
Bicycle of 1885	394
Bicycle of 1902	394
Photograph of Human Hand	396
Apparatus for Applying the X-Rays	398
Glacial Point, Yosemite Valley, Cal.	400
United States Battleship	415
United States Cruiser "Chicago"	416
Building a First-Class Battleship	417
Living Pyramids	430
Typical Coal Mine Opening	432
Sport of Falconry	449
Engine Transporting Guns	462
Skeleton of the Extinct Armadillo	463
Electric Railway in Prussia	464
The Sponge in Yellowstone Park	473
Electric Star at Paris Exposition	478
Making a Record on the Phonograph	481
Transporting Iron Ore by an Electric Railroad	482
New Railway Station in Berlin	484
Sport on the Ice in Germany	485
Remarkable Circus Feat	486
Beethoven at the Home of Mozart	488
New Niagara Bridge	492
Nansen and Party Hauling Supplies from the Ship	493
Dr. Nansen and Mr. Jackson	494
Nansen and Johansen Leaving the "Fram"	495
Caught and Wrecked in Arctic Ice	496
Terrific Eruption of Vesuvius	504
Diagram of the Volcanic Islands in the West Indies	510
Map of the Windward Islands	513
Lake Taupo and Volcanic Mountains, New Zealand	520
Natives of Jamaica Loading Bananas	523
Ship Passing through the Suez Canal	525
Minnehaha Falls, Minnesota	532
Famous Fortune-Teller	537
Seven Masted Schooner	540
Field Exercises of the Turners	544
Coaching in the Olden Time	558
First English Railway Train	559
Artist Who Paints with His Feet	560
Women Rolling the Roads at Hai-Fong	577

CONTENTS.

	PAGE
WIRELESS TELEGRAPHY	17
A Marvelous Achievement	17
Marconi and his Invention	19
Electric Waves Across the Atlantic.	19
Great Electric Force	20
A Practical System	20
Signals on Ships	23
Talking at Sea	24
Reporting the Great Yacht Race	26
TELEPHONE UNDER THE SEA	27
Ingenious Mechanism	27
Submerged Bells in Boston Harbor	27
Dangers of the Sea Minimized	28
THE MARVELOUS AIR SHIP	29
Great Invention of Santos-Dumont	29
A Man of Pluck and Courage	29
Personal Appearance of Dumont	31
Contrivance for Steering the Air Ship	32
Dumont's Description of his Invention	33
Expects to Travel 100 Miles an Hour	35
Russian Inventors of Air Ships	37
French Navy's Balloon	38
Count Zepellin's Dirigible Balloon	39
Plan of the Ship	39
Accident to Santos-Dumont	41
Dr. Barton's Balloon	43
"WHAT NUMBER, PLEASE?"	44
New System of Telephoning	44
Wires on the Intermediate Distributing Frame	44
Multiple Switch Board	45
Common Battery System	45
SUBMARINE BOATS	46
Fifteen Hours Under Water	46
The Marvelous Boat, "Fulton"	46
Navigation of the Bottom of the Sea	47
Story of the Submarine Boat Under Water	48
Report of Admiral Lowe	49
Description of the "Adder"	51
Torpedo Fired Under Water	52
Holland Boats in Great Demand	54
French Submarine Boats	56
Goubert's Submarine Boat	57
Opinions of the French Admiralty	58
HEROIC ACHIEVEMENTS	59
American Life Saving Crews	59
Captain who Rescued over 100 Persons	59
Wreck on the Coast of Massachusetts	60
Heroic Deeds of a Life Saving Crew.	61
Seven Heroes	62
Story of Captain Joshua James	62
TIMBER FLUMES OF CANADA	65
How Logs are Floated to the Saw Mills	65
Valuable Kinds of Wood in Canada	66
Adventures of the Lumber Men	65
Preparing Lumber for Exportation	66
THE AUTOMOBILE	67
History of Horseless Vehicles	67
Rapid Growth of Horseless Carriages	68
Our Country Taking the Lead	69
Poem—The Automobile	69
Columbia Electric Omnibus	70
New York's Fire Automobile	70
Combination Vehicle	72
Steam Pleasure Vehicles	73
Parts of the Machinery	73
Exhilarating Modes of Travel	75
EMINENT AMERICAN WOMEN	76
Women's League of New York	76
Margaret Livingston Chandler	76
Women in Municipal Affairs	77
Fighting for Pure Air	77
Wealthy Ladies and their Great Influence	77
WOMEN'S PATRIOTIC SOCIETIES	78
Daughters of the American Revolution	78
Mrs. Charles W. Fairbanks	78
Organizations of Vast Influence	79

PAGE

Promoters of Flag Day 79
Hundreds of Women Rescued . . . 79
PNEUMATIC ELEVATORS 80
Immense Structures in Chicago and Buffalo 80
Cargoes of Grain Loaded and Unloaded 80
Marvelous Pneumatic Invention . . 81
Great Wheat Traffic Across the Atlantic 82
WOMAN PROFESSOR OF PARLIAMENTARY LAW 83
Mrs. Urquhart Lee 83
Distinguished Testimonials 83
NEW SUSPENSION BRIDGE 84
Great Bridge between New York and Brooklyn 84
Dimensions of the Gigantic Structure 85
How the Foundations were Laid . . 86
Dimensions of the Old Bridge . . . 87
Great Difficulty of the Undertaking 87
THE ROLLER STEAMSHIP 88
Construction and Dimensions of the Ship 88
Commended by an Expert 89
The Screw Power 90
A FAMOUS LIGHTHOUSE 91
Apparatus for Building the Structure 92
Beacon Light on a Stormy Coast . . 92
NEW INDUSTRY FOR WOMEN 93
Women Learned to be Glass Blowers 93
Skill and Intelligence Required . . 94
How the Glass Tubes are Made . . 94
FAMOUS BANK 95
Age of the Bank of France 95
Notable Financial Success 95
Delicate Machinery Employed . . . 96
Perfect Organization 97
Making New Notes and Cancelling Old Ones 96
United States Money 98
WHITNEY'S COTTON GIN 99
Invention of Great Value 99
Whitney's Difficulties and Discouragements 100
Many Southern Planters Interested 100
An Ingenious Contrivance 100
Great Interest Excited 101

PAGE

Process of Ginning Cotton Described 101
Final Triumph of the Inventor . . 103
Whitney's Struggle for His Rights . 103
Machine that Revolutionized the Cotton Industry 104
QUEEN OF THE WATER LILIES 105
Large Tropical Plant 105
Cultivated in Hothouses and Gardens 105
Dimensions of this Wonderful Plant 106
SCENES IN NATURE 107
Parhelia, or Mock Suns 107
Arctic Mirage 107
The Aurora Borealis 107
The Spectre of the Brocken 109
The Fata Morgana 109
Mirage 109
St. Elmo's Fire 109
The Will o' the Wisp. 109
Aerolites, or Shooting Stars 109
Comets 109
Waterspouts 110
Avalanches 110
Geysers 110
To the Rainbow 110
VAST DEPOSITS OF GOLD 111
Latest Discoveries of Gold 111
Mines of Rich Metals in Alaska . . 112
Story of a Trip in Alaska 113
How Claims are Staked Out 114
Working the Sluices 115
Largest Nuggett ever Found on the Yukon 116
Extensive Deposits of Gold Quartz . 117
Rewards of the Miners 117
IN SEARCH OF GOLD 118
Description of the Gold Regions of Alaska 120
SINGLE SCREW STEAMER 125
Dimensions of the Steamship "Devonian" 125
Marvelous Steam Power 125
Great Carrying Capacity 126
LARGEST DINNER 126
King Edward's Gift to the London Poor 126
A Feast Followed by Entertainments 127

PAGE

Guests to the Number of 600,000 . . 127
THE GAME OF POLO 128
Description of the Game 128
Careful Training of the Ponies . . 129
CULTURE OF SILK 129
Our Country the Rival of France . 129
A Source of Vast Wealth 130
Description of the Silk Worm . . . 130
Ancient Mode of Weaving Silk . . 132
"Raw" Silk 133
Dyeing and Printing 133
TRUSTS 134
How Trusts are Formed 134
Great Monopolies and their Effects 135
How Legislation is Effected 135
Increase of Large Establishments . 136
Are Trusts Legal? 136
Probable Future of Trusts 137
President Roosevelt's View of Trusts 138
USES MADE OF SLATE 139
CANADIAN PACIFIC RAILWAY 140
Great Railway Across the Continent 140
Cost of the Inter-Colonial Railway 140
Visit of the Duke and Duchess of York 140
Great Wealth of Metals in Canada . 141
DIAMOND FIELDS 142
Millions of Money and Precious Stones. 142
Railroad Development in Africa . 142
Gold and Diamond Mines of South Africa 142
FASTEST PRINTING PRESS. 144
Capacity of this Wonderful Press . 144
New and Marvelous Improvements. . 145
Machinery that Thinks 147
Great Saving of Time. 147
Splendid Victory for Labor 148
Forests Turned to Paper 148
SCENES IN CENTRAL AFRICA 149
The River Niger 149
Story of a Scotch Explorer 149
Timbuctoo 151
Mohammedan Mosque 151
Wild Animals and Beautiful Birds . 151
HOW ACCIDENTAL DISCOVERIES LEAD TO GREAT FORTUNES 152
Edison's Discovery 153

PAGE

RUBBER TREES IN THE AMAZON VALLEY 154
River Amazon 154
Profitable Trees 156
Commercial Uses of Rubber 157
INGENIOUS CANAL 157
WALKING ON WATER 159
SOCIAL LIFE OF ANTS 160
Modes of Plundering 161
Ants Can Reason 161
Dr. Livingstone's Account of White Ants 163
Remarkable Dwellings Built by Ants 163
Immense Destruction Caused by these Insects 164
LARGEST ANIMAL IN THE WORLD . . 164
Remarkable Sagacity of an Elephant 165
Elephants In India Taught to Work 165
Remembering Injuries 165
Strong Attachments of this Animal 167
Antics of an Elephant 167
WONDERFUL PIECE OF ENGINEERING SKILL 169
Account of the River Nile 169
Work of Famous Engineers 169
How the Dams are Constructed . . 170
KIDNAPPING A MISSIONARY 171
Story of Miss Stone and Mrs. Tsilka 171
Large Ransom Offered for Their Release 171
Life of the Missionaries Among the Brigands 172
Meeting of the Missionaries with Their Friends 174
ISLAND OF CUBA 175
Recovering from Spanish Oppression 175
Rich Tropical Products 175
Public School System 176
Prisons, Improved 176
HAWAIIAN ISLANDS 177
Population and Territory 177
Products and Industries 177
PORTO RICO 178
Number of Population 178
Mineral and Vegetable Products . . 178
Island of Guam 179
Samoan Islands 179
PHILIPPINE ISLANDS 180
Climate and Mineral Wealth . . . 180

	PAGE
Agriculture and Chief Products	181
Territory Acquired by the United States	181
LIGHT AS A HEALER	182
Principles on Which it is Based	182
Mode of Applying the Remedy	183
DIVING STAGS AND HORSES	184
Wonderful Feats of Animals	184
Sagacity of the Horse	185
THE LONGEST RAILROAD	187
Great Trans-Siberian Railway	187
Story of Its Construction	188
Account of a Fascinating Ride	189
Towns Springing Up Everywhere	191
COUNT ROCHAMBEAU	192
History of a Remarkable Family	192
French Aid in the American Revolution	195
Splendid Valor of Rochambeau	196
GREATEST NATURAL WONDER	198
Magnificence of the Far-Famed Cataract	198
Dazzling Ice Formations in Winter	199
Niagara as a Water Power	200
A WOMAN'S PLUNGE OVER NIAGARA FALLS	201
Story of a Foolhardy Woman	201
Marvelous Escape from Death	202
LARGEST SCHOOL IN THE WORLD	203
Four Hundred Thousand Pupils	203
How the Instruction is Given	204
List of Questions	205
Colossal Educational Project	205
A CELEBRATED PAINTER	206
An Artist Without Arms	206
FAMOUS DISH FOR EPICURES	208
How Turtles are Prepared for the Market	208
Curious Creatures of the Sea	210
JAPAN: A WONDER AMONG NATIONS	211
A World Power in the Orient	211
Her War with China	212
Constructing a Navy	213
The Emperor and His Family	214
LIQUID AIR	215
One of Nature's Greatest Forces	215
How Applied to Machinery	218
Frightful Explosives	220
FAMOUS DRYDOCK AND SUBMARINE WORKSHOP	221
A GREAT INSTITUTION	222
Ten Million Dollars for Education.	222
Mr. Carnegie's Splendid Gift	223
Institution for Higher Education	224
MAMMOTH TREE GROVE	225
Giants of the Forest in California.	225
Dancing on the Stump of a Tree	228
Largest Tree Standing	228
Monster Trees of the Sierras	230
BREAKWATERS	230
Artificial Harbors	234
GREAT FISHING INDUSTRY	233
FAMOUS YACHTS AND RACES	236
Great Anglo-American Contest	236
"Columbia" and "Shamrock"	237
Story of the Race That Won the Cup for Our Country	239
Excitement Over the Victory	246
AN OSTRICH HARNESSED AND DRIVEN LIKE A HORSE	249
FIRST WOMAN PRESIDENT OF A TELEPHONE COMPANY	250
Remarkable Business Tact	251
Story of Her Achievements	252
A BOY'S SPEECH	253
VALUABLE FURS	254
Ermine for King Edward's Coronation	255
CURIOUS MODE OF TRAVELING	256
DISASTROUS SHIPWRECKS	258
Notable Calamities	258
Immense Loss of Life on the Ocean	259
Story of Many Lost Steamships	261
LARGEST SHIP AFLOAT	264
Famous "Oceanic"	264
A Monster of the Deep	266
Great Carrying Capacity of the "Oceanic."	267
SWISS SCENERY	268
Dangers of Mountain Climbing	269
Perils of Ascending the Far-famed Matterhorn	270
On the Top of the Matterhorn	274
Alpine Climbers Seeking Crystals	274
Exciting Adventures in the Alps	275
Famous Mount Rigi	278

PAGE

METEOROLOGICAL OBSERVATORY ON AN ALPINE PEAK 280
VARIETIES OF IVORY 281
EASTERN MERCHANTS AND THEIR CARAVANS 281
TO RESTORE DECAYED IVORY 282
A REMARKABLE DUEL 283
GENERAL JACKSON IN A PERSONAL ENCOUNTER 285
ANTAGONIST CAUGHT IN HIS OWN TRAP. 286
GIGANTIC BRONZE CANNON 287
NOTABLE WARSHIPS 288
STORY OF THE "FULTON" 289
CURIOUS DESIGNS FOR WARSHIPS . . . 292
GRAND CANAL OF CHINA 293
CURIOUS AMUSEMENTS 296
JUMPING ON STILTS 297
FRENCH POSTMEN ON STILTS 298
LONGEST RIVERS IN THE WORLD . . 299
THE MISSISSIPPI 299
MISSOURI RIVER. 299
THE COLUMBIA 300
THE YUKON 300
THE OHIO 301
RIVER PLATTE 302
THE AMAZON 302
THE FAMOUS NILE 303
THE VOLGA 303
THE YENESEI 303
HOANG HO. 303
DANUBE RIVER 304
RIVER EUPHRATES 304
RIVER GANGES 304
MOTOR WAR CAR. 305
BATTERY ON RAILWAY WHEELS. . . 305
HOW IT IS MADE TO TRAVEL. . . . 306
QUEEREST OF GAMBLING GAMES . . . 307
WHAT THE WORLD PAYS FOR THE LUXURY OF RULERS. 308
MODEST INCOME OF OUR PRESIDENT . . 308
INCOMES OF ENGLISH AND GERMAN KINGS 308
KING GEORGE OF GREECE. 309
KING OF ITALY 310
GENEROUS RULER 310
POVERTY OF SPAIN 310
THE STARS AND STRIPES. 311
HISTORIC FLAGS 311

PAGE

RATTLESNAKE FLAG 311
PINE TREE FLAG. 312
BETSY ROSS AND THE STAR SPANGLED BANNER 313
CONFEDERATE FLAG 314
BEET SUGAR INDUSTRY 316
ENORMOUS PROFITS 316
HOW BEETS ARE UTILIZED 318
FASTEST BATTLESHIP 319
REMARKABLE SPEED OF THE NEW "MAINE" 320
OUR ARMOR BELT 320
FIVE GREAT INVENTORS 321
THOMAS A. EDISON 321
PROFESSOR S. F. B. MORSE 323
ROBERT FULTON 324
JAMES WATT. 327
GEORGE STEPHENSON 330
MASTERLY INVENTION 331
MOST USEFUL METAL 333
USES MADE OF IRON 333
PROCESS OF REFINING 334
VAST SYSTEM OF IRRIGATION 335
DESERT LANDS TO BE RECLAIMED . . . 335
DEEP WELLS DRILLED 336
VAST UNDERTAKING BY OUR GOVERNMENT 337
GREAT RAILROAD TUNNELS . . 338
TRAINS TO RUN UNDER THE CITY OF NEW YORK 338
TUNNELS UNDER THE HUDSON AND EAST RIVERS 339
RAPID UNDERGROUND TRANSIT 340
STEAM SNOW PLOW 341
A MILLIONAIRE PATRIOT 342
ONE OF THE ASTORS, A SOLDIER. . . . 342
AN IDEAL PATRIOT 343
SKILFUL INVENTOR 343
GIANTS' CAUSEWAY 344
NATURAL WONDER OF THE IRISH COAST. 344
SUPERSTITIONS CONNECTED WITH THE PLACE 344
FAMOUS WISHING CHAIR 345
MAKING BREAD BY MACHINERY. . . 346
FINGAL'S CAVE 348
GREAT POLAR EXPEDITION 349
THE ANTARTIC OCEAN 349
SNOW, ICE AND VOLCANIC MOUNTAINS . 349
FIRST FLAG HOISTED IN THE ANTARCTIC CIRCLE 351

	PAGE
BEST ATHLETIC EXERCISES	352
How to Maintain the Health of the Body	352
Rules for Physical Exercises	353
Simple Tumbling Movements	355
HEALTH FOR AMERICAN WOMEN	355
Normal Activity of the Body	356
How to Create Force	357
Danger of Overeating	357
Cells and Tissues	358
HOW TO DEVELOP THE MUSCLES	359
Exercises for the Arms	360
Movements for the Lower Limbs	360
Modes of Breathing	361
How to Inhale	361
UNDERGROUND RAILROADS	363
Great Engineering Feats	362
Cost of Subways	364
Boston Subway	365
LONDON'S UNDERGROUND ELECTRIC RAILWAY	367
ELEVATED RAILROADS	369
Transportation for Crowded Cities.	369
Overhead Roads in London and New York	350
FIRE FIGHTERS	371
System of Sending Alarms	373
New Kind of Ladder	373
Improved Dress for Firemen	374
UNDERGROUND EYELESS WORLD	375
Blind Creatures in Caves	376
Sightless Fish and Insects	376
Wonders of Caves	376
FAMOUS AQUEDUCT	379
How the Croton River is Conducted	380
VIEWS IN THIBET	381
Dress and Ornaments	381
Thibet Mastiff	382
Chief Wealth of the Country	383
Curious Prayer Wheels	383
ONLY COMPLETE BUDDHA TEMPLE IN AMERICA	384
Cleansing Ceremonies	386
Curious Symbols and Idols	386
WONDERFUL FEATS ON THE BICYCLE	388
Celebrated Family of Athletes	389
Old-Fashioned Bicycles	391
Quaint Styles of Long Ago	392
WONDERFUL X-RAYS	395
Human Body Revealed	395
Looking Through Animals	397
How the Rays of Light are Applied	398
YOSEMITE VALLEY	399
Magnificent Scenery	400
Gorgeous Spectacle	401
Notable Mountains	402
Comparison with the Alps	405
Splendid Waterfalls	406
Dangerous Precipices	407
DEPARTMENTS AT WASHINGTON	408
The Executive Department	408
The Judicial Department	409
Legislative Department	411
FORETELLING THE WEATHER	412
Spiders as Weather Prophets	413
Regulating the Rainfall	413
OUR AMERICAN NAVY	414
Construction of our War Vessels	415
The Celebrated "Oregon"	416
Historic Vessels	417
MOST FAMOUS CATHEDRAL	418
UBLIME METEORIC SHOWER	420
Dazzling Display all Over the Country	420
People Panic-stricken	421
Amazing Phenomena of the Heavens	423
One Meteor of Great Beauty	427
BIGGEST METEORITE ON RECORD	428
Professor Ward's Accounts	428
FAMILY OF ATHLETES	430
VAST COAL BEDS OF THE UNITED STATES	431
Where Beds of Coal are Found	431
Coal in Other Parts of the World	433
EARTHQUAKES IN THE UNITED STATES	433
Hills Overthrown	434
New Hampshire Shaken	435
Escape of Gases	435
Earthquake at Charleston	437
LIST OF GREAT EARTHQUAKE DISASTERS	439
EARTHQUAKE IN THE WESTERN PART OF THE UNITED STATES	441
Great Rents in the Earth	444
Immense Lake Formed	444
Earthquakes in California	446

PAGE

SPORT OF FALCONRY 448
WEALTH OF THE PHILIPPINES 450
Rich Soil and Products 450
Rice Production 452
Available Imports 452
MOST WONDERFUL CLOCK 453
SEVENTEEN-YEAR LOCUST 454
Most Remarkable Insect 454
Locusts and Sparrows 455
FIRST INHABITANTS OF THE WESTERN WORLD 457
WHY MEN OUTNUMBER WOMEN . . . 459
NOVEL TRACTION ENGINE 461
Quick Transportation of Heavy Guns 462
THE EXTINCT ARMADILLO 463
THE ELECTRIC RAILWAY 464
UNCLE SAM AS A BUSINESS MAN . . 465
Men Who Draw Money from the Government 466
Grand Total of Salary List 466
Cost of the Federal Courts 467
Largest Item of Expense 467
AMAZONS OF RUSSIA 468
GREATEST ON EARTH. 470
Greatest Destruction by Fire . . . 470
Chicago's Great Fires 471
Highest Mountains 472
Largest Park in the World 472
Height of Principal Monuments and Buildings 474
The Washington Monument 474
Size of Lakes, Seas and Oceans . . . 475
Deepest Lake in the World 475
Longest Tunnels in the World . . 475
Capacity of the Largest Churches and Halls 476
ELECTRICITY 476
Marvelous Discoveries 476
What is Electricity 477
EDISON'S LATEST TRIUMPH 480
Coating Substances with Vapors of Gold 480
The Famous Phonograph 481
ELECTRICITY AS A MOTIVE POWER . 483
CAPITAL OF GERMANY 483
DANGEROUS CIRCUS FEAT 486
GREAT MUSIC COMPOSERS 487
Renowned German Masters 487

PAGE

Sublime Genius of Beethoven . . . 489
Unrivalled Pianist 490
NEW NIAGARA BRIDGE 491
Immense Span Across the Abyss . . . 492
Length and Height of the World's Greatest Bridges 493
FAMOUS POLAR EXPEDITION 493
Story of Dr. Nansen 493
Thrilling Achievements Among Polar Icebergs 494
Farthest North 497
The Polar Ocean 498
Future Explorations 498
YACHT WITHOUT A RIVAL 499
Splendid Vessel for the German Emperor 499
GROUP OF CURIOUS THINGS 500
Quaint Bell Tower at Tacoma . . 500
Indian Earrings 501
New Food Product 501
Chinese Taught Secretly 501
Exclusive Greenland 502
Yucatan Chewing Gum 502
Ancient Glass Painting 502
THRILLING STORY OF VESUVIUS . . . 503
Destruction of Pompeii 503
Story of Pliny the Elder 504
Awful Terrors of the Eruption . . 505
Great Loss of Life 507
DESTRUCTION OF ST. PIERRE BY AN ERUPTION OF MONT PELEE 508
Awful Catastrophe in the West Indies 508
Destruction of Forty Thousand Persons 508
Scenes and Incidents of the Great Calamity 511
Description of St. Pierre 514
Volcano of St. Vincent 515
Characteristics of the Inhabitants . 516
Man Saved in an Oven 518
Buildings Utterly Wrecked 518
Volcanoes in Hawaii 520
HEIGHT OF TWENTY-FOUR OF THE LOFTIEST VOLCANOES 521
JAMAICA'S VEGETATION 521
Luxuriant Tropical Fruits 521
Export Trade In Bananas 521

PAGE

GREAT CANALS OF THE WORLD . . . 524
- Famous Waterways 524
- Isthmian Canal 524
- North Holland Canal 525
- Welland Canal 525
- Suez Canal 526

PANAMA CANAL 526
- Right to Own and Operate 527
- Cost of Isthmian Canal 527

QUEER ANIMAL FREAKS 528
- Immense Lizards 529
- Monstrous Bats in Cuba 529
- Huge Rats 530
- Beautiful Cuban Birds 530

PICTURESQUE WATERFALL 531

BEAUTIFUL MODELS IN CLAY 533
- Ingenious Contrivances 534
- Models of Men and Women 534
- Costliest Wood 535
- Palaces of Splendor 535

NOTORIOUS FORTUNE TELLER 536
- Story of Gypsy Lee 536

WONDERFUL LONGEVITY 538
- Countess of Desmond 538
- "Old Parr" 538
- Robert Taylor 539
- Fifty Years Courtship 539
- Joseph Crele 539
- John Gilley 539
- How to Attain Great Age 539

SEVEN-MASTED SCHOONER 540
- Largest Ship of its Kind 540
- Dimensions of the Vessel 540
- Vastness of Tonnage 541

GIGANTIC SPIRAL QUARTZ COLUMNS . 542
- A Puzzle to Men of Science 542
- Their Organic Origin 543

FAMOUS CLUB OF ATHLETES. 544
- History of the "Turners" 544

WONDERS OF COLORADO 545
- History of the State 545
- The Population 546
- Singular Rock Formations 546

RESTAURANT WITHOUT WAITERS . . 547
- Orders Served by Electric Trolleys 547
- Power Supplied by Niagara 548
- Deep Wheelpits 548
- Cooking by Electricity 548

PAGE

PETROLEUM INDUSTRY OF THE UNITED STATES, ... 549
- Story of Pennsylvania Oil Fields . 549
- How Oil Wells are Bored 550
- Uses Made of the Oil 550
- Owners Growing Rich 552
- Oil Wells on Fire 552
- Fortune in Barrels 554
- "Coal Oil Johnny" 556
- Made from Marine Plants 557

ANCIENT MODES OF TRAVEL 558
- Old English Coach 558
- Mail Coach of the Rocky Mountains . 558
- Slow Railroad Trains 559

AN ARTIST WITHOUT ARMS 560

STORY OF A PIRATE 561
- Notorious Robber and Murderer . . 562
- Caught and Found Guilty 562
- History Related by Himself 564
- Touched by the Appeal of a Woman . 565
- Execution of Gibbs 566

GREATEST BATTLES OF THE INDIAN WAR 567
- War with the Kentuckians 567
- Jackson's Campaign Against the Indians 567
- Washington in Command 568

MARVELOUS ACHIEVEMENTS OF ASTRONOMY 573
- Triumph of Mathematics 574
- Great Problem Solved 574
- Famous Telescope 575
- Aid of Photography 575
- The Sun is a Star 576
- Brilliant Wonders 576

WOMEN EQUAL TO OUTDOOR WORK . 577

THE BUILDER OF EMPIRES 578
- Remarkable Career of Cecil Rhodes 578
- Four Diamond Mines 579
- Large Output of Gold 580

GREATEST AUTHORS, ORATORS AND STATESMEN 581
- Allen, Elizabeth Ackers 581
- Andersen, Hans Christian 581
- Bancroft, George 582
- Blaine, James Gillespie 583
- Boker, George H. 584
- Booth, Edwin 585
- Brooks, Phillips 585

	PAGE
Browning, Elizabeth Barrett	585
Browning, Robert	586
Bryant, William Cullen	586
Byron, Lord	587
Campbell, Thomas	588
Carlyle, Thomas	588
Carnegie, Andrew	588
Cary, Alice	588
Cary, Phoebe	589
Choate, Rufus	589
Clay, Henry	589
Cleveland, Grover	590
Cross, Marian Evans Lewis (George Eliot)	590
Depew, Chauncey M.	590
Dickens, Charles	591
Emerson, Ralph Waldo	592
Garfield, James A.	592
Gladstone, William Ewart	593
Gough, John B.	593
Grady, Henry Woodfin	593
Grant, Ulysses S.	594
Harrison, Benjamin	594
Harte, Francis Bret	595
Hawthorne, Nathaniel	595
Holland, Josiah Gilbert	596
Holmes, Oliver Wendell	596
Hood, Thomas	597
Hugo, Victor	597
Jackson, Thomas J. (Stonewall)	598
Lincoln, Abraham	598
Longfellow, Henry Wadsworth	599
Lowell, James Russell	600
Macaulay, Lord	601
McKinley, William	601
Moody, Dwight Lyman	602
Payne, John Howard	602
Poe, Edgar Allen	602
Riley, James Whitcomb	603
Saxe, John Godfrey	603
Talmage, Thomas DeWitt	603
Tennyson, Alfred	603
Mark Twain (S. L. Clemens)	604
Stowe, Harriet Beecher	604
Scott, Sir Walter	604
Webster, Daniel	605
Willard, Frances E.	606

LIST OF ILLUSTRATIONS.

Wireless Telegraphy Between England and France..... 18
Instruments Used in Marconi's Wireless Telegraphy..... 21
Warning Bell Under a Floating Telephone Station..... 28
The Air Ship of Santos-Dumont..... 30
Santos-Dumont Seated on the Bicycle Saddle of His Air Ship..... 32
Santos-Dumont in the Basket Car of His Air Ship 34
Santos-Dumont Rounding the Eiffel Tower in His Air Ship..... 36
Model of Dr. Barton's Navigable Baloon..... 40
A Unique Flying Machine..... 43
Answering Calls at a Telephone Exchange..... 45
Holland Submarine Boat in Harbor. 47
Interior of a Submarine Boat..... 50
Launch of the First Submarine Boat at Barrow..... 53
Submarine Boat Fouling a Fishing Smack 55
Section of the Goubert Submarine Boat 57
Life-Saving Apparatus at Work..... 60
Life-Boat Hurrying to the Rescue 61
A Timber Flume in British Columbia 66
The King's New Method of Traveling 68
Modern Mode of Traveling by Bicycle and Motor Car 71
The Hare and the Tortoise Retold —The Hare Leads 74
Pneumatic Elevator Unloading a Cargo of Wheat. 81
How Pneumatic Grain Elevators Unload a Vessel 82
New Brooklyn and New York Suspension Bridge..... 85
Approach to the New Brooklyn and New York Bridge..... 86
Roller Steamship "Ernest Bazin" 89
The Building of Beachy Head's New Lighthouse..... 92
A Visit to the Bank of France..... 96
Interior View of the Bank of France..... 97
Cotton Bale Ready to Be Removed from Press 102
Victoria Regia, the Largest Blossoming Plant. 106
Marvels of Nature 108
The Wash-Up: a Scene on Miller Creek, Klondike..... 112
Result of the Year's Wash-Up..... 116
Indian Medicine Men Stilling the Waves 119
Indian Village, Nulato, Alaska.... 122
A Polo Pony Tandem Race..... 128
Reeling Silk from Cocoons in Japan 131
Tourists Ascending One of the Inclines in a Quarry 139
Lady Minto and Party Riding on a Cowcatcher..... 141
Largest and Fastest Printing Press in the World 146
The Niger and Timbuctoo..... 150
Tapping Rubber Trees in the Amazon Valley 155

FEATS ON A BICYCLE SUSPENDED FROM THE CEILING

PINE-APPLE GROVE

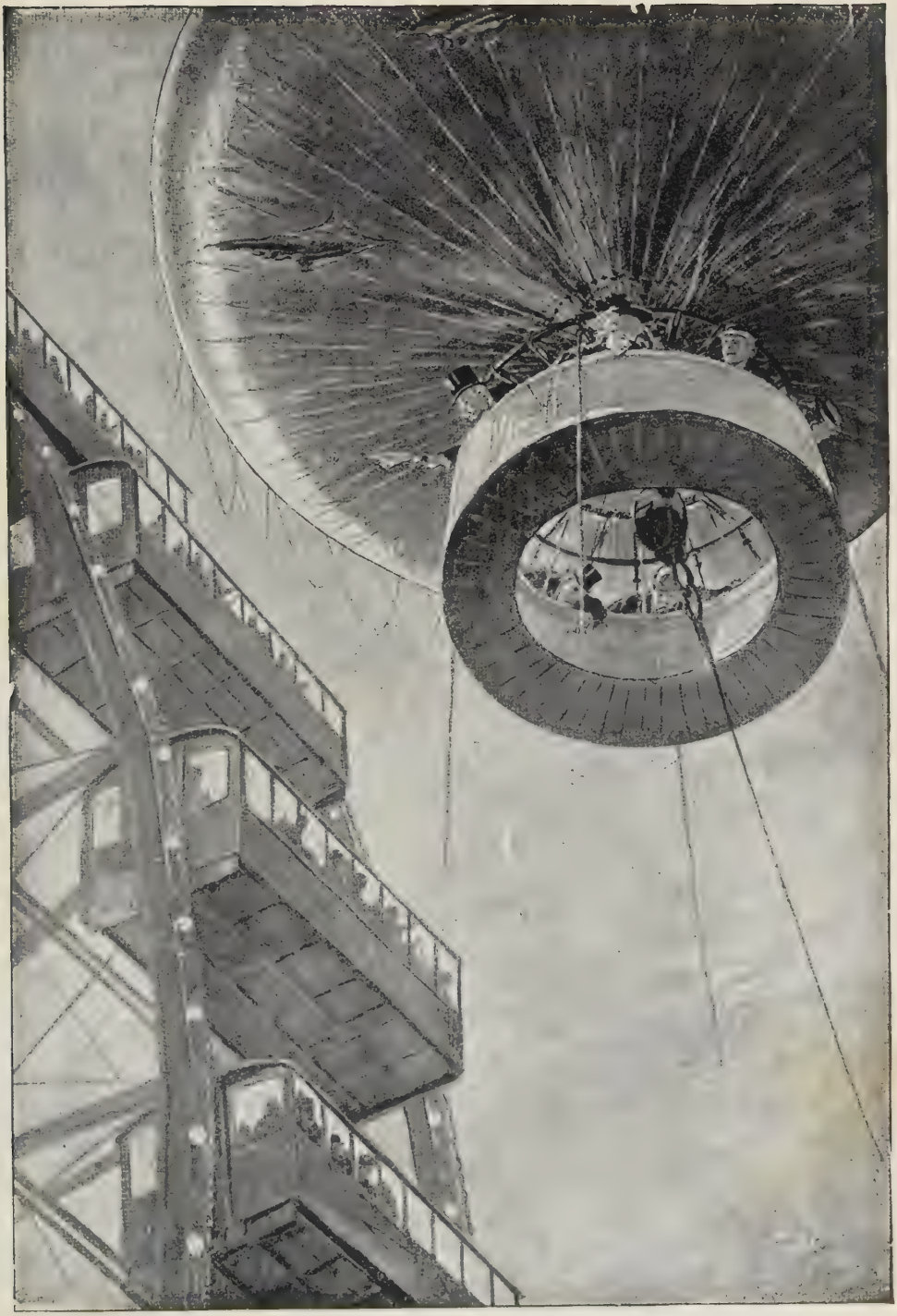
THE PINE-APPLE IS A NATIVE OF TROPICAL AMERICA WHERE IT GROWS WILD, BUT BY CULTIVATION HAS BEEN MUCH IMPROVED AND IS A LARGE STAPLE OF EXPORT TRADE

JOHANNESBURG MINE—TRANSVAAL

SORTING HOUSE WHERE THE QUARTZ AND WASTE ROCK ARE SEPARATED

CHINESE WORSHIPING THEIR ANCESTORS

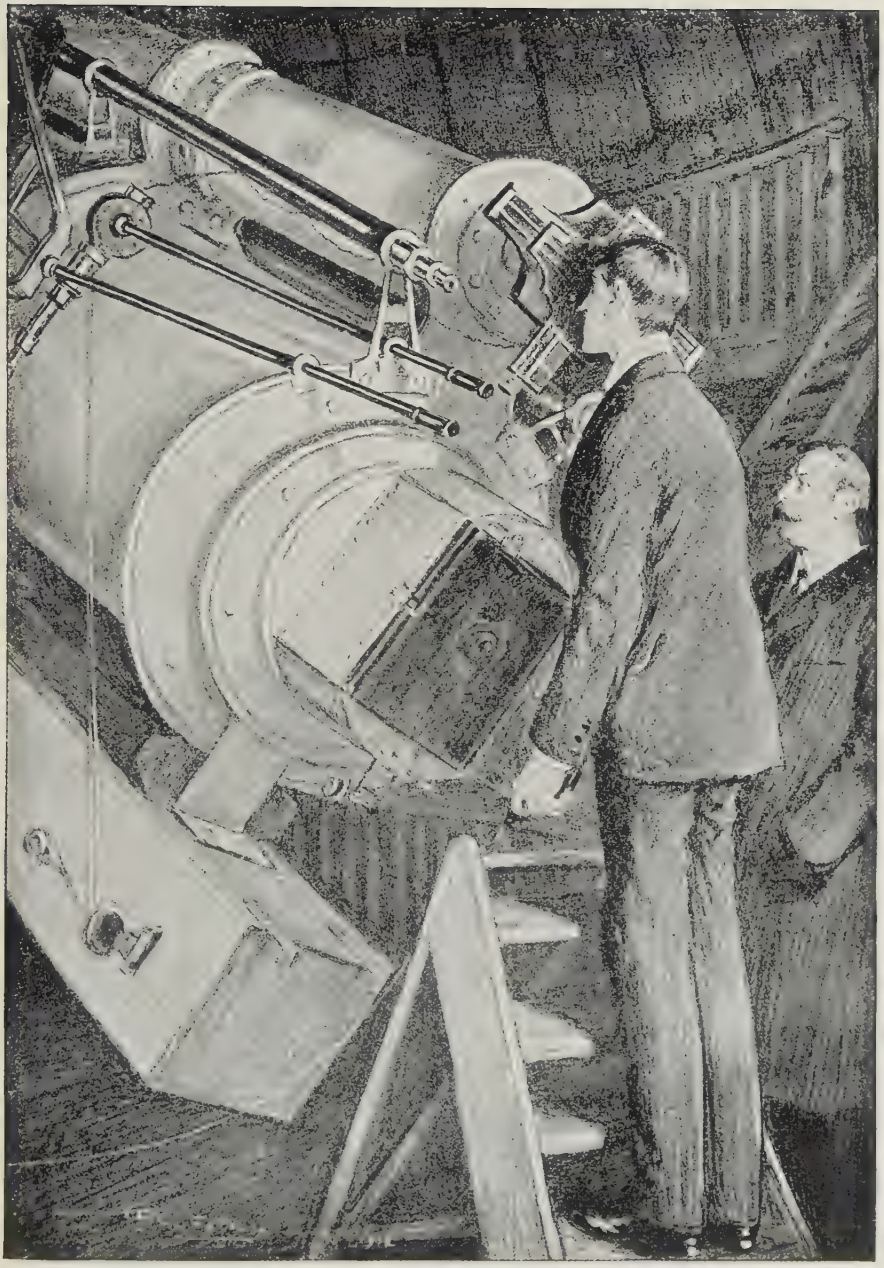
ON CERTAIN DAYS IN THE YEAR ALL THE MEMBERS OF A CHINESE FAMILY PROCEED TO THE BURIAL-GROUND CARRYING INCENSE, SANDAL WOOD, CANDLES, FOOD AND DRINK OF ALL KINDS, AND AFTER A BLESSING PLACE THEM ON THE GRAVES OF THEIR FOREFATHERS



MEETING IN MID-AIR OF BALLOONISTS AND RIDERS
ON THE FERRIS WHEEL

IMMENSE CACTI

THE FLOWERS ARE OFTEN OF GREAT SIZE AND BEAUTY, AND THE FRUIT OF MANY SPECIES IS CONSIDERED DELICIOUS



MAKING DISCOVERIES IN ASTRONOMY

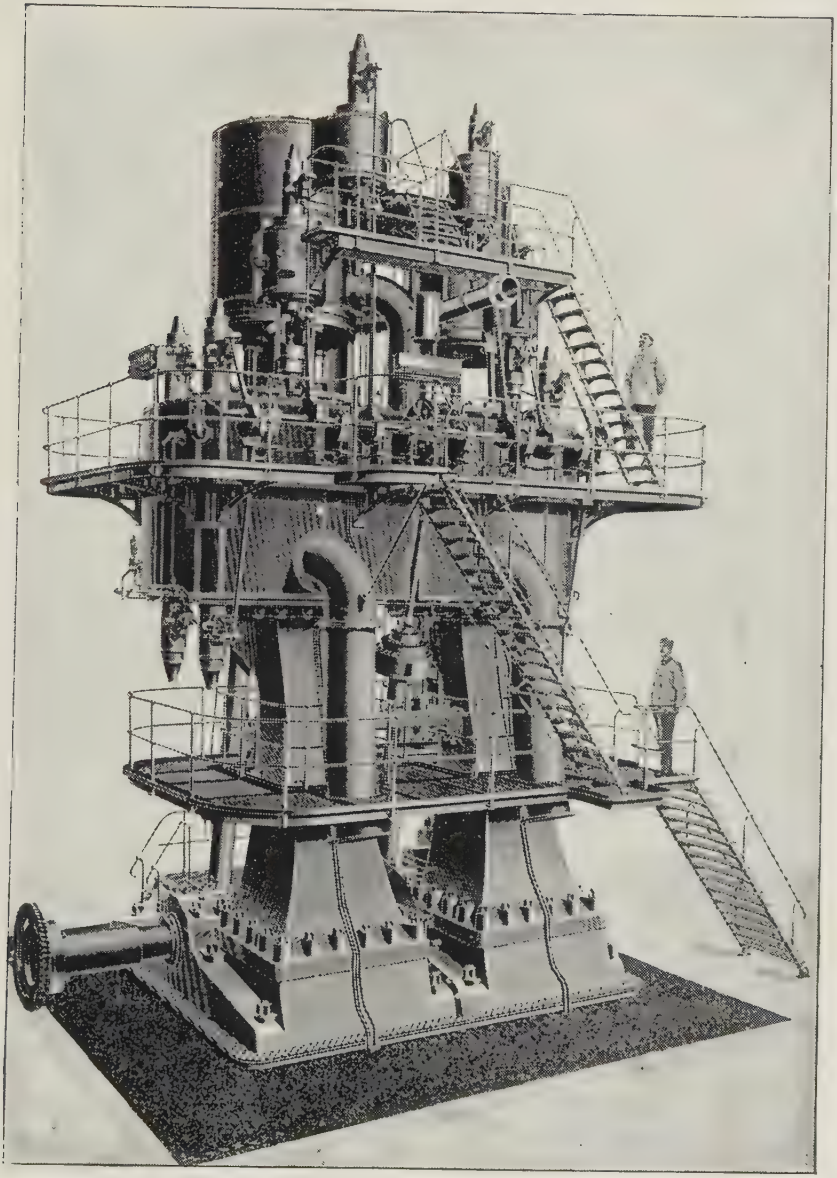
THE MACHINE HERE PICTURED IS USED FOR PHOTOGRAPHING THE SUN AND STARS, THE OPERATOR IS IN THE ACT OF TAKING A PHOTOGRAPH

WOLFERT'S TUNNEL AND RAILWAY, LAKE OF CANTONS, SWITZERLAND

RAILWAY FOR WOOD SLEDS IN THE VOSGES MOUNTAINS, FRANCE

SEALING UP THE SULTAN'S DINNER IN THE KITCHENS AT YILDIZ

TO PROTECT THE SULTAN FROM POSSIBLE POISONING THE MOST RIGOROUS PRECAUTIONS ARE TAKEN IN THE PREPARATION OF HIS FOOD. THE PALACE OFFICIALS INSPECT THE DISHES, SEAL THEM WITH A LARGE RIBBON AND CONVEY THEM, UNDER A STRONG GUARD, TO THE SULTAN



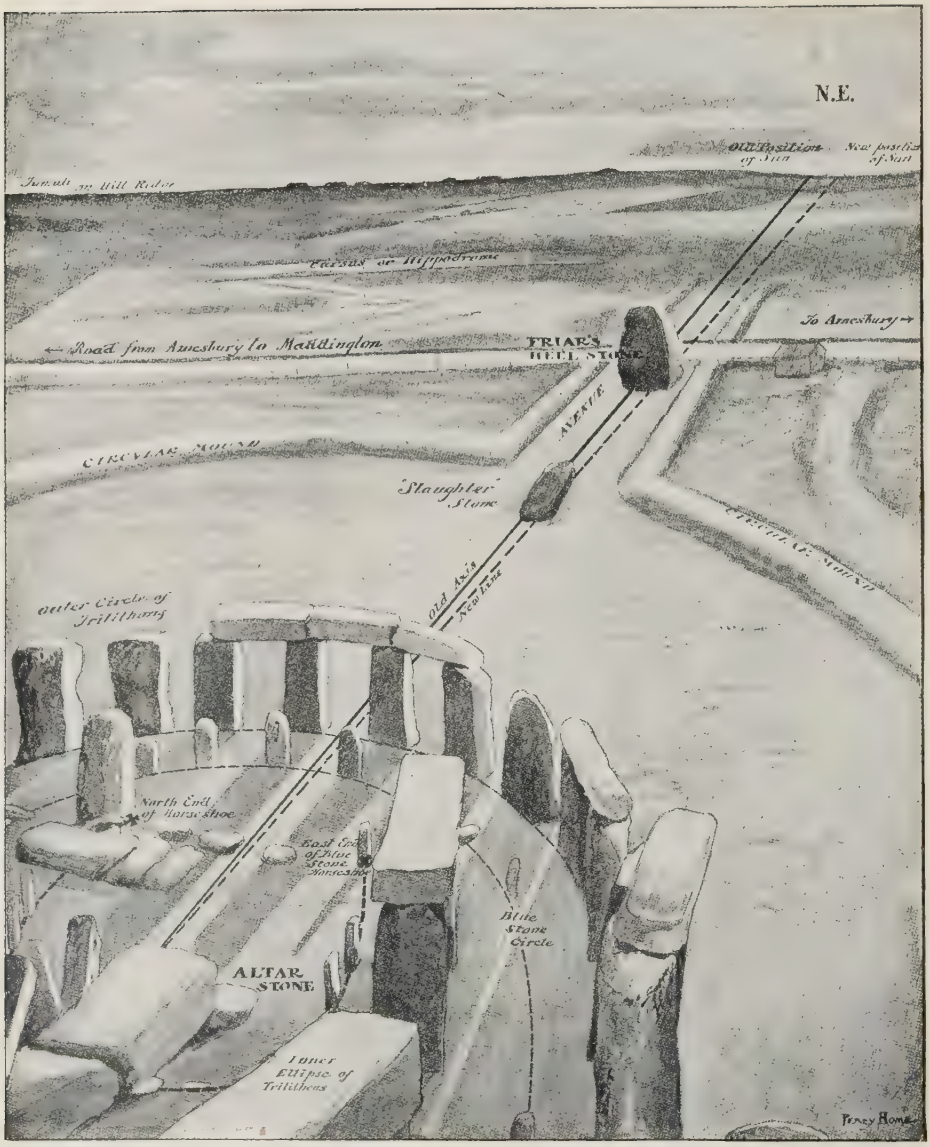
GIANT DYNAMO AND TRIPLE EXPANSION ENGINE

A CENTRAL ELECTRICAL STATION

BY THE TURNING OF A SWITCH ON THE LEFT SIDE OF THE PICTURE, ONE DISTRICT IS LIGHTED. BY THE TURN OF ANOTHER THE SAME WILL HAPPEN TO ANOTHER PORTION OF THE TOWN AND SO ON UNTIL EVERY PART IS LIGHTED

WONDERFUL FEATS OF BOXING HORSES

THE TWO STEEDS BOX WITH TWENTY OUNCE GLOVES, TAKING CORNERS JUST LIKE PRIZE FIGHTERS. THEY COME TO THE FRONT AND SHAKE HANDS, AND USE THEIR GLOVES WITH MORE SCIENCE THAN SOME HUMAN BOXERS



STONEHENGE—REMAINS OF AN ANCIENT DRUIDICAL TEMPLE, SALISBURY PLAIN, ENGLAND

An attempt is being made to solve the problem of the age of Stonehenge by means of modern astronomy. The theory which is being worked upon is that formerly the collection of stones pointed towards the rising sun, on June 21st, the day on which the sun reaches its most northerly position. Looking from the Altar Stone one sees the sun rising near the top of the Friar's Heel on June 21st. But each year, on the longest day, it rises a little less to the North than it did the previous year. The amount of the yearly shift in the sun's position is known, so that by calculating the difference between the sun's present position and the position it held on the old axis of Stonehenge should give some solid proof of the age of this wonderful " temple of the winds."

DR. ANDREE'S BALLOON VOYAGE

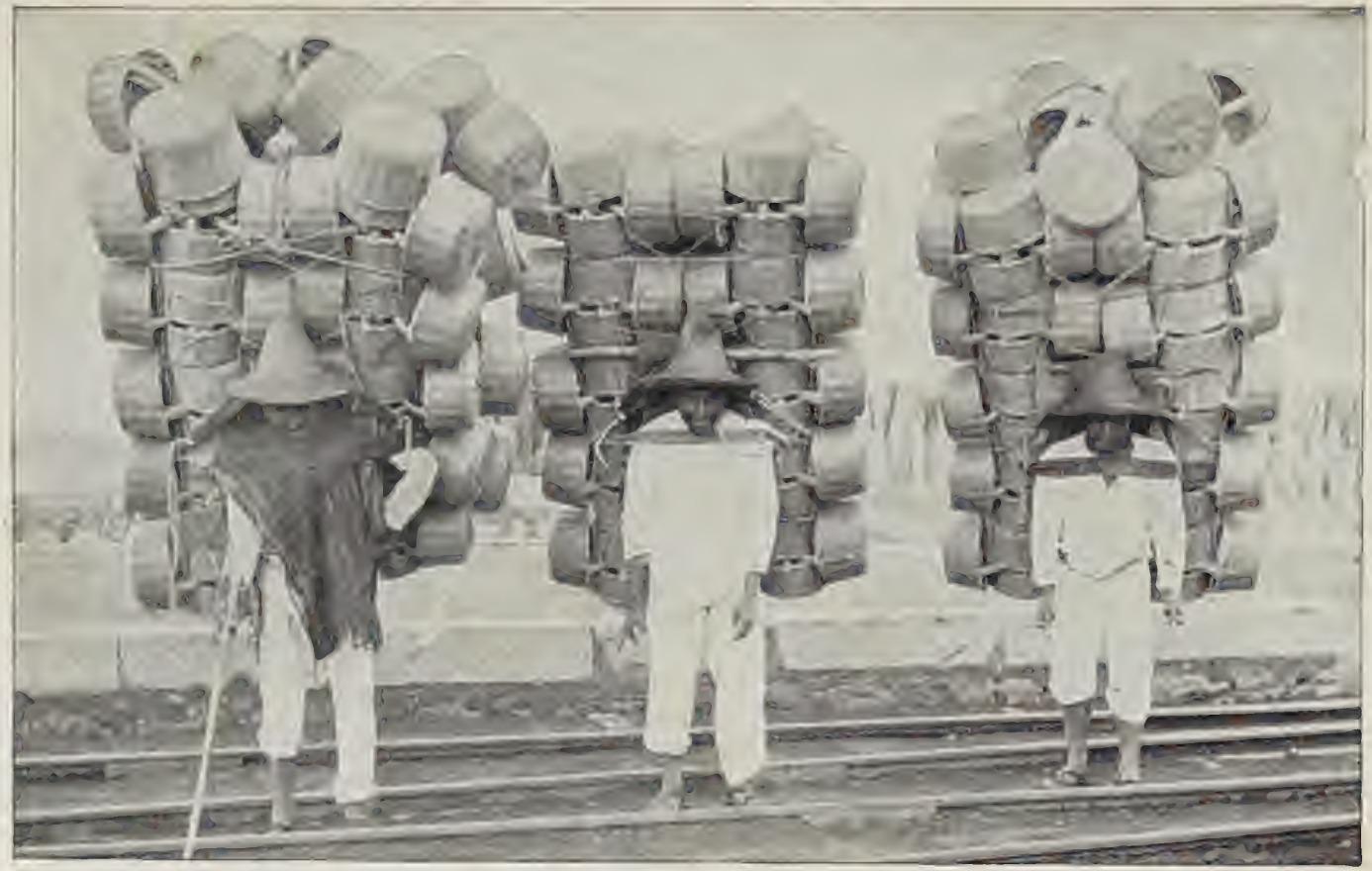
DEPARTURE OF THE "EAGLE" FROM SPITZBERGEN

WATERFALL IN THE YOSEMITE VALLEY, CALIFORNIA

FAMOUS NATURAL BRIDGE OF VIRGINIA

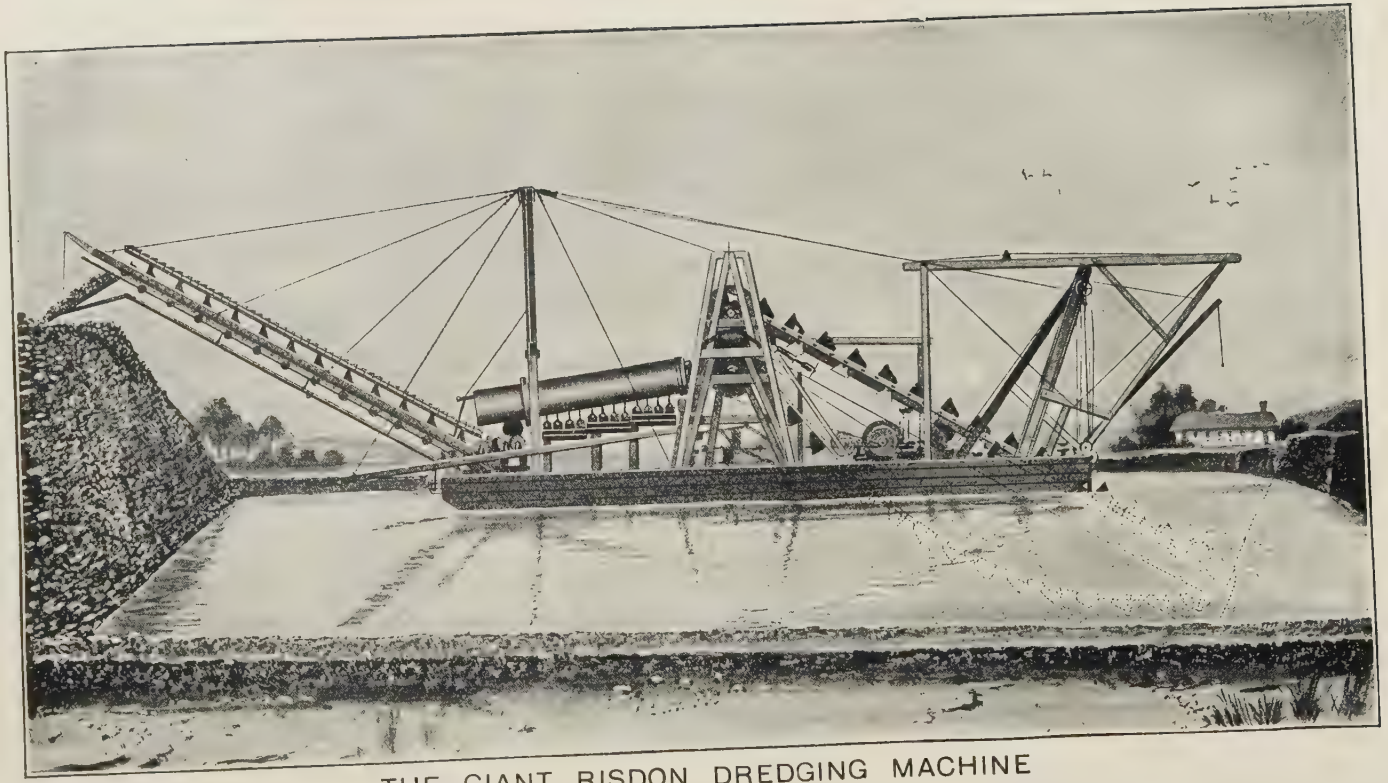
MEXICANS DRAWING PULQUE FROM THE AGAVE PLANT

IT REQUIRES FROM TEN TO SEVENTY YEARS, ACCORDING TO CLIMATE, FOR THIS PLANT TO ATTAIN MATURITY, WHEN IT PRODUCES A GIGANTIC FLOWER STEM AND THEN PERISHES. THE FERMENTED JUICE IS THE "PULQUE" OF THE MEXICANS



WHOLESALE LOADS OF MEXICAN BASKETS

SURPRISING SKILL IS SHOWN BY THE NATIVE BASKET MAKERS, WHO FIND A READY MARKET FOR THEIR WARES



THE GIANT RISDON DREDGING MACHINE

Capacity 5,000 cubic yards of dirt every twenty-four hours. Doing the work of 500 men and requiring only four men to operate it. This dredge is operated by electricity. The dredge will dig from a depth of 30 feet below the surface of the water and elevate the tailings to 30 feet above the water level, which will enable it to handle a bank at least 15 feet above the water level. The bucket belt consists of 32 heavy, substantial buckets, each of a full 5 cubic feet capacity. The dredge has in the [illegible] load of 200 tons of machinery on board, and costs about $50,000 in complete running order.

WIRELESS TELEGRAPHY.

Most Wonderful Discovery of Modern Times—Messages Transmitted Hundreds of Miles Without Wires—Ships Signalled Long Before their Arrival in Port.

NOT until recently did anyone dream of such a marvelous achievement as sending messages long distances over land and water without any apparent medium for conveying them, except empty air. In the rapid progress of scientific discovery what would once have been considered impossible has been accomplished, proving the truth of the old saying that wonders never cease. Although a number of names are associated with various discoveries and inventions in connection with Wireless Telegraphy, a young Italian has gained the greatest prominence and his brilliant achievements have given him a world-wide fame. Mr. Marconi was led to make his first investigations by hearing the subject mentioned one evening at a social gathering in London, of which city his mother was a resident before taking up her abode in Italy.

Seized with a sudden impulse to discover whether Wireless Telegraphy was a mere conjecture or a splendid reality, he set to work with an energy and enthusiasm worthy of the object he had in view. The extraordinary results of his labors are known to the whole world

The accompanying photograph represents the installation of Wireless Telegraphy fitted up by Signor Marconi and his assistants between Wimereux, a small village near Boulogne, and the South Foreland, in England, a distance of about thirty miles across the English Channel. Communication was established and has been uninterruptedly maintained, notwithstanding storms and fogs, the messages being recorded with absolute precision and unfailing regularity throughout the whole time. Our illustration shows the tall mast which has attracted so much attention in Wimereux. It is made in three parts, and looks very fine and ship-shape with its trim stays in all directions. From its top, which is 150 feet above the ground, a wire is suspended which is carried through a window into a room of an adjacent building, where it is connected with the instruments. It is this simple wire which exchanges signals with another suspended from a similar mast at the South Foreland.

At Poldhu, in Cornwall, near the Lizard, on the South coast of England, is located the largest electric station

employing Mr. Marconi's system of Wireless Telegraphy, which, it is confidently asserted, has sent a message across the Atlantic. It was built and designed expressly for long distance signalling. The gradual development of the efficiency of the system foreshadowed the time when more ambitious efforts should be made, and Mr. Marconi prepared for this with the thoroughness characteristic of all his

WIRELESS TELEGRAPHY BETWEEN ENGLAND AND FRANCE, SHOWING MARCONI'S RECEIVING STATION AND SIGNAL MAST.

undertakings. The electric force generated there is equal to about thirty horse power, and as compared with his ordinary stations the force is about one hundred times greater.

This store of electric energy is sent into the ether through twenty masts, each 210 feet high. These provide a giant conductor, being united together, and before Marconi visited Newfoundland ample tests were made between Poldhu and other stations in the British Isles and Northern Europe as to the power of this transmitter; but that it was possible to send the electric waves across the Atlantic was believed in by few except himself. Hence he kept this phase of the matter a profound secret, and gave out that his business was the conducting of experiments with the ocean liners.

Operations Begin.

But he had arranged with the electricians at Poldhu to send a certain signal during certain hours daily after a date to be determined by him subsequent to his arrival at St. John's. After reaching St. John's and selecting an experimental base on Signal Hill, at the entrance of St. John's Harbor, whence an unbroken stretch of ocean extends to the British coast, he forwarded to his associates a cablegram directing them to begin their operations. They followed their instructions, the hours set being 3 to 6 P. M. Greenwich time (11.30 A. M. to 2.30 P. M. St. John's time). He, in the meantime, sent up balloons and kites, elevating the aerial wire which should catch the signals if the tests were satisfactory. Before an adjustment could be completed, his first balloon broke clear, and was lost. Thereafter Mr. Marconi used kites only.

He sent up a kite, which reached a height of 400 feet in mid-air, and remained there four hours. Attached to it was the aerial electrode, and the lower extremity of this was fixed to a Marconi receiver. This is his own invention, and is an extremely sensitive instrument; but, instead of trusting to the automatic recorder, which forms part of it, he used a telephone attachment, the human ear being more reliable in extreme cases, as it enables the operator to detect signals too faint for the recorder to disclose.

It was by means of this telephone that Marconi received the signals from the Poldhu station. They consisted of the letter "S," forwarded in the Morse characters, three sharp dots (. . .). These were repeated at intervals, beginning at 12.30 P. M., and lasting, irregularly, for three minutes; resuming at 1.10, and renewing at 2.20 for shorter intervals.

No Possible Mistake.

But the signals were conclusive; no other agency could deliver them except the Poldhu station; the safeguards Mr. Marconi provided, which cannot, for business reasons, be given in detail, were such as to make a mistake impossible. His chief assistant, Mr. Kemp, received the signals as well as Mr. Marconi, and they both agreed as to the genuineness of the message.

A prominent journal commented on this great achievement as follows:

"Mr. Marconi has made one of the most wonderful achievements of modern science, wonderful as that is. At his wireless telegraphy station at St. John's, Newoundland, he received electric sig-

nals across the Atlantic Ocean from his station in Cornwall, England. Before leaving England he had made his plans for accomplishing this result, for, while his primary object was to communicate with ocean liners in mid-ocean, he also hoped to succeed in attaining the wonderful scientific achievement of wireless telegraphy across the Atlantic.

Great Electric Force.

"Mr. Marconi's station in Cornwall is most powerful. He possesses an electric force generated there 100 times greater than at his ordinary stations. Before he left England he arranged with the electrician in charge of the station, to begin sending signals daily after a certain date, which Marconi would cable him. Marconi erected an experimenting station on Signal Hill at the entrance to St. John's harbor. He cabled the English station to begin sending signals at 3 P. M. daily and to continue them until 6 P. M., these hours being respectively 11.30 A. M. to 2.30 P. M., St. John's time.

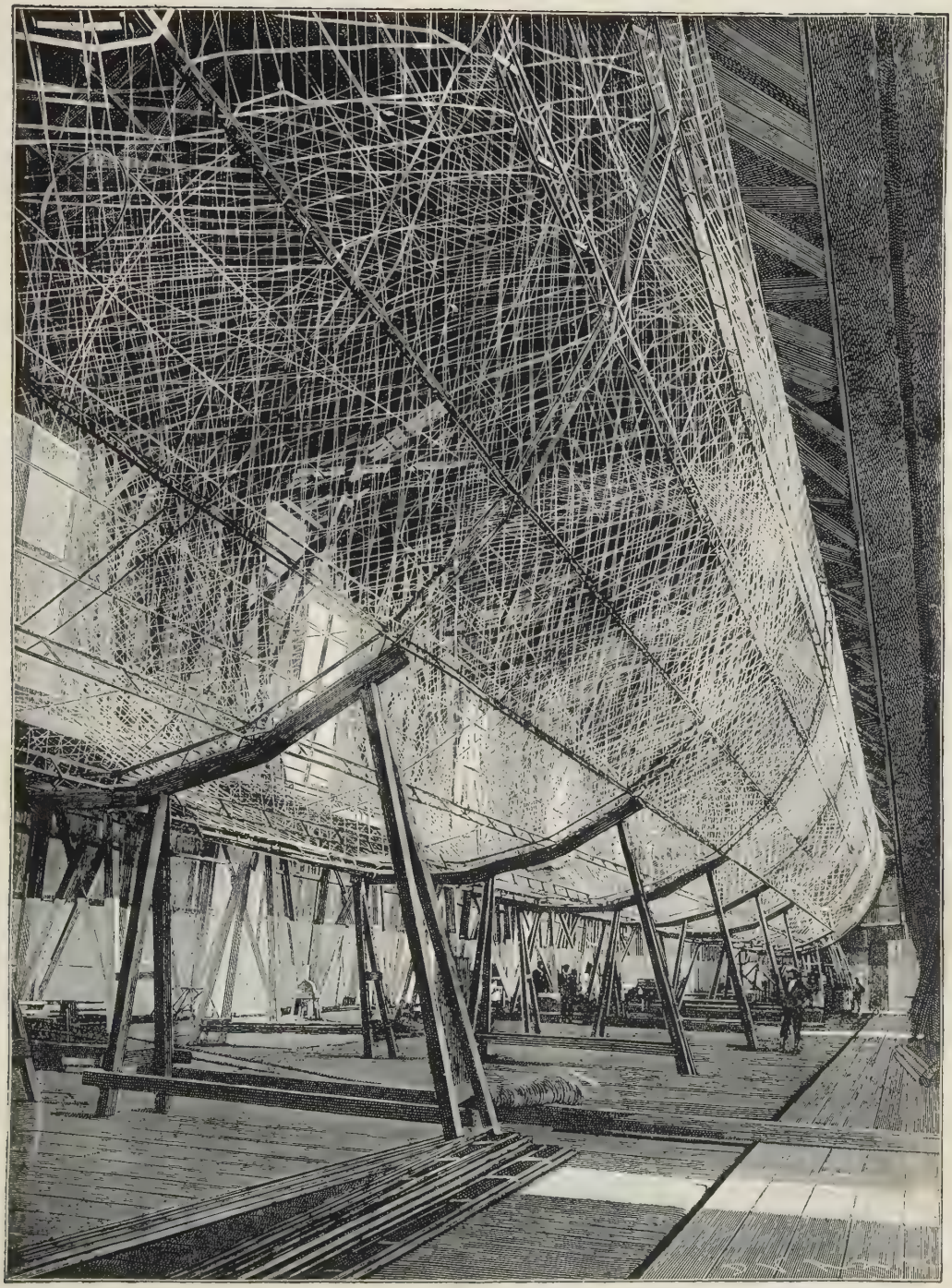
"During these hours on December 11th, Marconi elevated a kite with an aerial wire by means of which signals are sent or received. To his profound satisfaction, signals were received by him at intervals, according to the program arranged previously. These signals consisted of repeating at intervals the letter 'S,' which in Marconi's code is made by three dots or quick strokes. This signal was reported so frequently, and according to the detailed plan arranged to provide safeguards against possibility of a mistake that Marconi was satisfied that it was a genuine transmission from England.

"Again, on the following day, during the same hours, the kite was elevated and the same signals were renewed. This made the assurance so complete that Marconi cabled to his principals in England and also informed the Governor of Newfoundland, who apprised the British Cabinet of the success of the experiments. Marconi, though satisfied of the genuineness of the signals and that he has succeeded in his attempts to establish communication across the Atlantic without the use of wires, emphasizes the fact that the system is yet only in an embryonic stage, but that the possibility of its ultimate development is demonstrated by the success of the experiments with incomplete apparatus, as the signals can only be received by the most sensitively adjusted apparatus.

A Practical System.

"The Cornwall coast is 1,700 miles from St. John's. That there is something tangible and practical in wireless telegraphy is evidenced by the fact that the Anglo-American Cable Company, which has exclusive privileges for ocean telegraphic communication in Newfoundland has taken measures to prevent any further experiments in that province.

"A further item in the development of this wonderful system is reported by the Cunarder 'Etruria' on a trip to New York. She was in communication for more than five hours in mid-ocean with her sister ship, the 'Umbria.' Long before either ship sighted the other their commanders were conversing by the Marconi wireless system. The position of each ship was known on the other hours before their maintrucks showed above the horizon.



GIANT AIR-SHIP OF THE COUNT OF ZEPPELIN

PAINTING THE EIFFEL TOWER, PARIS

"The 'Etruria' left Liverpool on December 7th, the same day the 'Umbria' steamed out of New York. They were 1,630 miles east, northeast Sandy Hook when they passed each other. Five hours before that, or when they were fully 100 miles apart, the receiver on the 'Etruria' began to click warningly. The operator replied and then the 'Umbria' was slowly spelled out on the Etruria's' instrument. Then followed the 'Umbria's' location. The 'Etruria' replied, giving her location, which showed her to be fully 100 miles away from the other vessel. The 'Umbria' sent her number of passengers, the fact that all was well and all the latest news from New York. The 'Etruria' exchanged the latest news from Liverpool."

INSTRUMENTS USED IN MARCONI'S WIRELESS TELEGRAPHY.

That Marconi's attempt to send dispatches across the Channel was successful

is a fact. Experiments as to the distance which may intervene between stations were promptly made. Companies have been capitalized in order to continue the experiments and so improve the system that it may prove a powerful factor in the commercial world.

Marvelous Inventions.

Marconi has absolutely annihilated time and space by proving that wireless telegraphy across the Atlantic is no idle dream; our knowledge of the firmament above us has been increased by the discovery of a new star; while the triumphs of Santos-Dumont in the ocean of air lead to the thought that we may yet witness the realization of Tennyson's beautiful poetic vision, and see

> "The heavens fill with commerce, argosies of magic sails,
> Pilots of the purple twilight, dropping down with costly bales."

Returning to Europe after his experiments at Newfoundland, Mr. Marconi still further proved on his voyage that his claims for long distance communication without wires were not ill founded or visionary. In a little deck house on the American liner "Philadelphia" Mr. Marconi communicated over miles and miles of sea with his assistants who were bending over the instruments at a station near the Lizard light. From before eleven o'clock one morning, when the ship was 120 miles from the station, until almost three o'clock the next morning the inventor left the key only to take hurried meals. A correspondent of a prominent journal who was on board relates a conversation he had with the famous inventor:

"About the letter 'S,' which you used as a signal, sent from England to Newfoundland, there has been much discussion as to whether you really received signals sent from the Cornish coast or whether your instruments in Newfoundland were affected by electrical disturbances."

"I have," said Mr. Marconi, "explained this point a number of times, but I am not unwilling to go into the matter again, inasmuch as those who do not believe in Wireless Telegraphy have made it the fundamental argument of their statements that I have not proved that the ocean could be bridged by my system. I went to Newfoundland with but one purpose in view. I believed from my experiments that it was possible to transmit a wireless telegraphic signal from England to Newfoundland.

Concerning the Letter 'S.'

"From my experience I came to the conclusion that all that was necessary was a current powerful enough. With this end in view I equipped the station at Poldhu with far more powerful instruments than we had ever used before and arranged that upon a certain day between certain hours the letter 'S' should for three hours be sent out from this station. It was to be repeated for ten minutes, then the operator was to rest five minutes, then to send the letter 'S' for ten minutes more, then rest five minutes, and so on, for three hours.

"Notwithstanding drawbacks, the signals were received at the proper time, were continuous for ten minutes, then stopped five minutes, then began for ten minutes, and so on. I had proved what I went to Newfoundland for; that was to demonstrate that wireless telegraphic

signals could be sent from England to that shore.

"It was from a commercial point of view that I conducted these experiments, for it would have been unbusinesslike to have expended large amounts of money in equipping long-distance stations without having demonstrated at first and at the least possible cost that signals could be sent across the ocean. I am fully convinced that the sending of long-distance messages doesn't depend on the height of the vertical wire, as I once thought, but upon the power of the current employed. A station similar to that of Poldhu will be erected on the American coast. We shall both send and receive signals at first and complete messages afterward. Of that I feel confident."

"You were quoted, Signor Marconi," said the correspondent, "as stating that it was your next intention to establish a wireless telegraphic service between England and India?"

"That," said Marconi, "is not exactly true. What I said was that, if—and I so believe—it is feasible to talk from England to America by Wireless Telegraphy, it is also possible to communicate between England and India."

Signals on Ships.

"What about the opinion of certain experts that there is no reliability to be placed upon wireless messages, and that they can be intercepted by anyone who chooses to erect a station equipped with the proper instruments?"

"That," said the inventor, "is something I am working upon now, with, I most firmly believe, a prospect of ultimate success. Besides, except in the case of a government being involved, it is hardly likely that anyone would go to the expense of, say $70,000, to erect a wireless telegraphic station that would be able to intercept long-distance messages."

Thus incoming and outgoing transatlantic liners are now able to communicate with the shore by wireless telegraphy when many miles out of sight. The first practical use for Wireless Telegraphy has proved to be the shortening of the period of isolation of a transatlantic liner when on the journey from Liverpool to New York. By means of the unseen electrical impulses given off from a perpendicular wire a whole day is subtracted from the period when the voyagers on an ocean steamer are cut off from knowledge of the world.

"All Well on Board!"

The first message sent by this means came from the "Lucania" on one of her voyages. As the evening approached the operator on the vessel began to "feel" for the lightship at Nantucket, where the "New York Herald" had erected its Marconi pole. He sent a few impulses into the upper air, and as soon as he received a reply he rapped off the captain's message, "All well on board. We are 287 miles from Sandy Hook, with clear weather, and expect to reach New York on Saturday. Please inform Cunard agents."

Since then many messages have been given and received at both ends of the voyage. A most interesting unconcerted attempt was made by Mr. Kronche of the "Kaiser Wilhelm der Grosse" to keep in touch with the outgoing "Lucania." The big German vessel was lying at her New

York berth when the "Lucania" slipped down the river towards Sandy Hook. After a time the telegraphist thought he would try to send a last message to the English vessel.

"L L L," he sent. It was the call across the water by the new code.

"L L L," he called again, and after some little time the instrument beside him flashed in response, and the dots and dashes upon the tape unrolled into the words, "Here. Sorry I kept you waiting. Send twenty signals." This latter is a precaution to give an opportunity to adjust the instruments. The twenty flashes were sent and then the operator at the pier received the signal, "O. K.," meaning that all was ready.

"Hear signals very well," he then flashed to the 'Lucania.'"

"Thanks," came the reply. "Very glad you hear signals well. It is raining cats and dogs."

Talking at Sea.

After a pause Mr. Kronche sent another message to his fellow-worker:

"Wish you a happy and speedy voyage. How far are you out now?"

"Thank you. Hope you have pleasant voyage, too. Near Sandy Hook. Good bye."

He thought the limit had been reached, but the man on the steamship at the dock did not give up. He was like one clinging to an old friend's hand at the gangway.

"L L L," he called again, and heard the response.

"Signals very good," he sent rapidly. "Hope to have long communication today. How far are you now?"

The man on the "Lucania" heard although the steamships were more than thirty miles apart. "Past Sandy Hook," was the answer. They tried again and again, but the limit had been reached, and if the signals reached the "Lucania" they could not be answered.

A message is sent from a Marconi pole by charging it from an instrument which causes a spark to traverse the length of the wire. This traversing of the wire sets up electrical impulses which spread out in every direction like the ripples on a pond or just as light streams in every direction from a lamp. When these waves, which are sent out either long or short on the Morse system, encounter another Marconi wire their electrical energy flashes down it into the "coherer" and the "relay" instruments, which in their turn actuate the dot-and-dash tape instruments. The original energy received by the wire is so slight that in itself it would not be able to actuate an instrument, but by means of the "coherer" it is just sufficient to set in motion local batteries which do the work of printing the message.

Exchanging Messages.

The steamship "Philadelphia" broke the record for the longest distance communication with the land by the Marconi system. When, soon after leaving their European port, they found themselves off the Lizard, they exchanged messages with the station there, continuing this from noon until midnight of the following day. The last message was sent when the ship was 150 miles distant from the land. On account of the extreme weather, the captain put into Cherbourg harbor and remained sixteen hours,

and the connection was kept up all the time.

In an interview, Marconi said he was prepared to pay five hundred dollars to anyone who could interrupt or read one of his wireless messages. He said he intended to commence operations by cutting the transatlantic cable rates one-half and would afterwards reduce the rates for short distance land service. As an indication of the assured character of the science, the Marconi Company has made a contract with Great Britain for the installation of its wireless system on naval vessels for fifteen years at fifty thousand dollars a year.

Grand Achievements.

On account of the prominence which Wireless Telegraphy has attracted by its recent achievements and its great possibilities of becoming an important factor in the commercial world, it is very interesting to note the various stages by which this important method of communication has been reached, and the many scientists to whom the world is indebted for the present efficiency of the system.

In 1850, Professor Henry, of Washington, D. C., discovered that particles of carbon and steel were very sensitive to electrical discharges, and would act under electrical oscillations through the air (this being the forerunner of the "coherer") being an imperfect electrical contact. Professor Hughes, of London, in 1880, also experimented with "aerial" telegraphy with some success.

In 1882, Professor Amos Emerson Dolbear, of Tuft's College, Boston, Mass., applied for a basic or art patent for wireless telegraphy and telephony; after being held in the United States Patent Office for four years, the Commissioner of Patents demanded a working model of the system, claiming that they could not understand it, as it was a new art, and the practical workings entirely unknown to them. Professor Dolbear supplied the apparatus, making a practical demonstration of the same, and was granted a patent October 5, 1886, it being the first patent in the world of a practical working wireless telegraph apparatus. Professor Dolbear worked his system in actual practice at that time between Blue Hill and Boston Light, a distance of over thirteen miles. All who are using wireless telephony and telegraphy in the United States, therefore, necessarily infringe upon this basic patent, which is still in force.

Electric Waves.

Professor Heinrich Hertz, in 1889, explained the phenomena of "electric etheric waves" and established the fact (by demonstrating through the spark of his induction coil) that these waves were identical with the ordinary light waves, having the power of being reflected and refracted; thus solving the curious phenomena which had puzzled the savants up to that time. In 1887, Sir William Preece experimented with wireless telegraphy in the English Channel, and subsequently rendered able assistance to Signor Marconi. In 1890, Professor E. Branley, of Paris, discovered the small sensitized tube called the "coherer," the connecting link of modern wireless telegraphy. In 1891, Professor Oliver Lodge, of Liverpool, sealed the "Branley" tube, after having exhausted the air therefrom, thereby making it more sensitive.

In April, 1895, Professor A. S. Popoff, a distinguished Russian naval officer (Professor in the Torpedo School for Officers), constructed, demonstrated and operated the first modern and complete wireless telegraph apparatus, which, with slight modifications, is now used in all systems the world over, and this system is now in successful use by the Russian and French navies. Professor Popoff's invention was so remarkable that it was heralded far and wide by the scientific journals of the day, which published his treatises and illustrations, the electricians of the world believing the problems had thereby been solved, it being made so plain that any one ordinarily versed in electrical science could construct such apparatus from his descriptions. In July, 1897, Gugliemo Marconi received a United States patent for an apparatus constructed on similar lines to that of Popoff, as illustrated in Russian and French scientific journals in 1895.

Reporting the Great Yacht Race.

Professor Marconi has attracted world-wide attention by the successful operation of his system, telegraphing across the English Channel between Dover and Calais in March, 1899, and subsequently erecting wireless stations across the English and Irish coasts. In 1899, Professor Marconi reported the international yacht races, a license for this purpose having been granted by the owners of the Dolbear patent, under whose auspices Professor Marconi was then employed for this purpose. But far more wonderful have been his later achievements.

Professor Slaby, of Berlin, Germany, is also the inventor of a system which is now used in the German navy, and over which Emperor William is very enthusiastic. Professor Slaby claims that in conjunction with Mr. Dietz, he made many experiments with "spark telegraphy" before Marconi's invention became known. The various further inventions and improvements in Wireless Telegraphy in America have since been made by Professors Collins, Shoemaker, Davis, Tesla, Pickard, Passenden and Ehret.

On April 1, 1901, Marconi surrendered his United States patent, claiming it inoperative and too broad in its claims, citing that Professor Popoff having eighteen months previously published a discovery and system similar to his and, therefore, after claiming his ignorance of this fact (at the time of his filing same) he was granted a modified issue in June, 1901. The priority of Professor Dolbear's (the American) is a claim made now over all others in the world. There is, however, a controversy between Professors Marconi and Slaby regarding the question as to whom is due the credit of priority of invention on certain other improvements in Wireless Telegraphy.

Marked Improvements.

Professor Harry Shoemaker, a rising young American inventor, has made many marked improvements in Wireless Telegraphy, for which he has received fourteen American patents, as well as patents in foreign countries. Professor Shoemaker's patents mark an important epoch in the art of telegraphing without wires, covering, as they do, a complete "selective" system, by which interference is entirely obviated. Professor Shoemaker's tuning system is also very re-

markable, it being perfectly adapted to practical and commercial uses, this having been fully demonstrated during the international yacht races off Sandy Hook, where Professor Shoemaker's system in reporting the yacht races, proved to be the only successful one, sending as many as 103 bulletins in three and one-half hours.

Professor Nathan Stubblefield, of Kentucky, who came upon the scene with a wireless telephone and who successfully talked from his residence to the court house, a distance of about three blocks, has followed on the lines of Dolbear's invention, and made a distinct advance in the use of the telephone.

TELEPHONE UNDER THE SEA.

Messages from Submerged Bells—Ingenious Mechanism—Sounds Distinguished at a Distance of Three Miles.

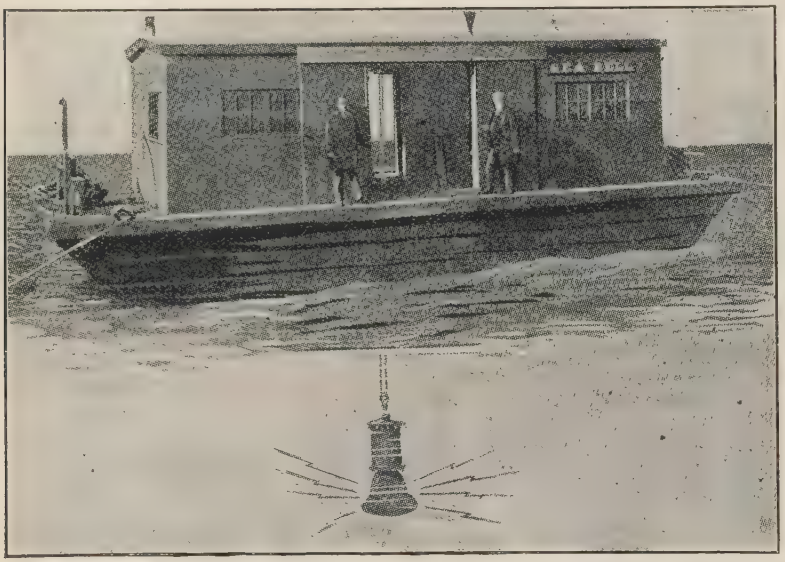
AN interesting wireless submarine telephone system has been installed in Boston Harbor. By it vessels may be warned of approach to a dangerous coast or rock and the presence of a submarine torpedo-boat may be learned on a threatened warship, while communication may also be exchanged between a vessel and a signalling station or between two vessels.

It is the invention of a Boston man, Mr. Arthur J. Mundy, who produced the apparatus in conjunction with the late Professor Elisha Gray, of telephone fame.

Briefly, the theory of the new system of signalling is that of using the water as a medium for conveying sounds just as Marconi uses the air. Sound travels much faster in water than in air, and after numerous experiments a bell was discovered to be the best instrument for producing and spreading sound under water. Two submerged bells now ring at the entrance to Boston Harbor to warn ships of danger on the rocks, in fog, in storms, and at night.

Both these bells are rung electrically, one from a lighthouse and the other from the floating telephone station, the Sea Bell. This latter craft, of which we reproduce a photograph, is interesting as the possible successor of the present lightship. She is equipped with an 800 pound bell, which is operated electrically. By an ingenious mechanism it may be rung continuously just as a church bell is tolled, or it may be made to ring any desired number or numbers at the will of the operator, who is thereby enabled to send intelligent messages, each letter of the alphabet being represented by a given number.

It has been found that at the distance of a mile or more the sound of the bell is heard distinctly by the unaided ear. It comes through the water and passes through the sides of the ship into the atmosphere of the hold, and is there recognized by the ear just as any local sound might be. When in an open boat the tolling of the bell is usually heard quite plainly for a distance of five miles.



WARNING BELL UNDER A FLOATING TELEPHONE STATION.

To enable a vessel to pick up the sound at a distance of three miles a kind of ear trumpet has been devised. For a greater distance an electrical receiver is employed by means of which the bell has been heard twelve miles away. One end of each of the latter devices is lowered over the ship's side or attached to it on either side of the bow under the water-line like a pair of ears. The wire is carried to the pilot house, and the moment the sound strikes the receiver in the water it rings a gong at the other end whenever the submerged bell is rung.

For answering and sending messages from a ship a different kind of apparatus is employed. Powerful gongs are placed on the sides or bottom of the boat which are sounded by electrical devices. The great charm of the whole system is its reliability. All navigators know the tricks the air plays with fog-signals. A horn or bell buoy may be heard very distinctly one minute and the next be inaudible owing to the varying density of the atmosphere. In water, however, sound waves are not subject to any such variations.

Fogs are the danger of the sailor. The old ship captain gets nervous when the atmosphere is thick and he can see only a few rods ahead, even by putting the glass to his eye. The advantage of having an apparatus that will care nothing for fogs, and will give its warning sounds through the water, is obvious. It minimizes the many dangers of the sea.

This is another example of the numerous uses to which our science of electricity, which has advanced at such enormous rates in a few years may be applied. The lightnings of heaven are made to serve the wants of man, and are yoked to the car of progress in every department.

A SILK COTTON TREE

IT PRODUCES SILKY FIBRES IN GREAT ABUNDANCE, WHICH ARE USED FOR STUFFING PILLOWS, MATTRESSES, ETC. THE TREE AFFORDS PROTECTION AGAINST HURRICANES

SOCIAL FEAST OF NATIVES, HAWAII

THE MARVELLOUS AIR SHIP

Problem of Aerial Navigation Solved by Santos-Dumont—The Latest Flying Machines—Voyages in the Air with Vehicles Easily Guided and Controlled.

SHALL we ever fly? Yes. The success of Santos-Dumont has again called the attention of the world to the subject of aerial navigation. Only a comparatively few years ago any one who studied and experimented with a view of ultimately navigating the air was placed in the same category as the seekers after the Philosopher's Stone and perpetual motion. There was some excuse for this, for we find that the whole subject was practically in the hands of hare-brained inventors, charlatans, and mountebanks.

It is only recently that one could study his question without being looked upon as a crank. Things have greatly changed lately, and we find to-day that some of the cleverest scientific men in existence are studying the question of aerial navigation with a fair chance of success.

The would-be navigators of the air are divided into two classes—namely, those who propose to navigate the air by machines lighter than the air, that is, by balloons; and those who propose to navigate the air by machines heavier than the air—true flying machines, which, like a bird, depend upon the development of an enormous amount of dynamic energy in proportion to the weight of the machine. A great many attempts have been made to navigate the air by means of elongated balloons. Gaston Tissandier met with some degree of success with an elliptical balloon driven by an electrical motor.

Then the subject was taken up by the French Government, and a great number of experiments were made under the direction of Commandant Renard. These experiments demonstrated that a cigar-shaped balloon could be propelled through the air at a moderate velocity, but it was found by actual experiment that if the balloon was made fish-shaped—that is, full forward and slim aft—the speed, with a given amount of power, was considerably increased. Commandant Renard on several occasions succeeded in propelling his balloon some seven or eight miles, and returning to the point of departure.

But all these excursions were made in a dead calm.

Whenever there was a wind that was barely perceptible on the surface of the earth, it proved to be too strong for the balloon, and on such occasions the balloon did not succeed in returning to the point of departure, but travelled with the wind just like any other balloon. It would appear that Commandant Renard always

relied upon electrical motors driven by accumulators for his motive power, and, as is well known, accumulators are extremely heavy, and their number therefore limited, so the power at his disposal would be extremely small.

THE AIR SHIP OF SANTOS-DUMONT DESCENDING AFTER SUCCESSFULLY ROUNDING THE EIFFEL TOWER IN PARIS.

Commandant Renard did not consider it safe to use a petroleum motor driven by explosions where it would be in close proximity to an enormous amount of highly inflammable gas.

But it would appear that Santos-Dumont is at least a man of pluck and courage. He has taken the bull by the

horns, and has provided his cigar-shaped balloon with a very light, high-speed petroleum motor, and by this means he has had at his disposal a great deal more power in proportion to the bulk and weight of his machine than has heretofore been employed, and he has been able to start out and make a short tour and return to the point of departure while a light wind was blowing, which has always been impossible with all other experimenters.

It will, therefore, be seen that Santos-Dumont has made a direct step in advance, for he has demonstrated that, under favorable conditions, a balloon may be made which will travel over a considerable distance propelled by its own machinery, and that it can even make progress against a light wind.

A Daring Inventor.

The most daring inventor in the world—the absolute personification of indifference to physical danger—a man who has carried into practical execution things which once were laughed at as the ravings of a mad-brained fool—such is Alberto Santos-Dumont, the only man in the world who has successfully navigated an airship in the teeth of a steering breeze. He is the most interesting figure in the mechanical inventive world, but was formerly laughed at as an impractical theorist, who, if he had the courage of his convictions, would find his theories shattered by the dashing out of his brains in the collapse of one of his crazy schemes. It has fallen to his fortune to be courted by everyone. The change is indeed a startling one. Santos-Dumont was twenty-four years old when he began his experiments. In four years he accomplished what all the inventors and scientists from the beginning of the world have pronounced to be impossible, and, with apparently the best part of his life and career before him; who can tell what he will do, or to what length his genius will lead him? Already he has laid the foundation for such a revolution of existing conditions as have never occurred before in all the revolutionary and turbulent periods in the world's history. A mode of navigation in the air would work incalculable changes.

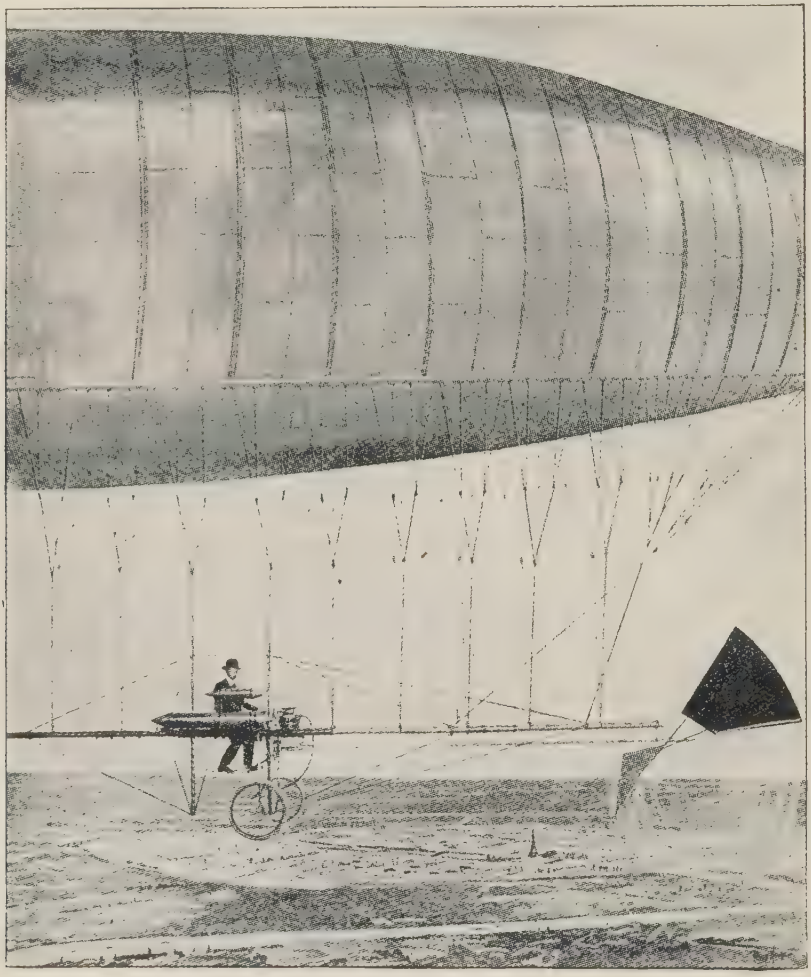
Santos-Dumont bears his laurels modestly, yet at times, especially when he talks of his work and what he will do in the future, he has an air of such absolute self-confidence that he seems almost boastful. Yet a close study of the man shows that he is not boastful. He is simply so absolutely imbued with the convictions of his own theories that he speaks of them with the same confidence that one makes the statement that two plus two make four.

Personal Appearance.

When one hears of the wonderful nerve, the coolness in the face of danger which would appal the stoutest hearted man in the world, the absolute indifference to risk which this young man has displayed time and again in his flights with his airship, one expects to see a big lusty bold-eyed fellow, with a gigantic frame and muscles. The contrast of this ideal to the real Santos-Dumont is so great as to be surprising.

Santos, as he prefers to be called, is a little thin, swarthy skinned youth of five feet and may be four or five inches in height. His face would be effeminate were it not for the thick, though closely cropped moustache which shades his upper lip and lends strength to his whole

face. His chin shows, however, whence he gets the dogged stick-to-itiveness and the wonderful grit which has enabled him to keep on working until at last he has reached his great eminence.



SANTOS-DUMONT SEATED ON BICYCLE SADDLE OF HIS AIR SHIP.

One of the most puzzling problems in aerial navigation is how to steer the ship. A balloon will go with the wind, but the wind may not be blowing toward the point you wish to reach. An airship, to be of any practical value, must have an apparatus by which it can be steered.

As shown in the drawing, Santos-Dumont, who is an engineer by profession, sits on a light metal shaft to which an ordinary bicycle saddle is affixed. On his right, and partly in front of him, is a gasoline motor, which, when started by the bicycle pedals below him, rotates the propeller at the front end of the shaft. The propeller measures twelve feet in diameter, the fans being made of steel and aluminium, covered with silk, in order to cut the air easily. The propeller makes 180 revolutions to the minute, a speed of twenty miles an hour.

The question which a representative of a prominent journal discussed with Santos-Dumont was not whether or not we shall ever fly, so much as the extent to which we may expect aerial flight to develop. As a fact, we never shall fly—in the strict meaning of the term—according to the inventor. He is careful to differentiate flying and aerial navigation. Birds fly, but man is not a creature of the air and has no wings for flight.

"If you mean aerial travel by means of artificial wings, I do not think we ever shall fly," he said to the writer. "We are only on the fringe of the venture yet; but we have advanced far enough, I think, to enable us to see that there are vast possibilities for aerial travel. But it is the man skilled in mechanics who will be successful, not the man who strives to imitate the birds."

"Then you do not anticipate that you will find a pattern in nature for the successful mechanism?"

Human Power Limited.

"I cannot see why we should expect to do so. In what have we been able to copy nature? I never knew of an artificial man outside fiction. I have heard of no locomotive that goes upon legs. If you take a ship for comparison, are we not struck by the fact that the vessel riding on the top of the water is like a dead fish? The submarine? Well, where is the resemblance, except in the fact that the submarine, like the fish, travels beneath the water? The fish has no propeller; it has fins. No, I do not believe that we must look to nature for our model. We are going to fly, in a manner of speaking, but it will not be by the aid of wings. Motors and screws will have to do the work."

"Many people in Paris are engaged upon experiments at present. Do you anticipate good results?"

Not Visionary.

"I am very hopeful, indeed. We have at last come to the time when a man may devote himself to the study of the subject without being stamped as crank or visionary. Eminently skilled engineers are now taking up the subject. Hitherto there has been good ground for the ridicule levelled at those who have devoted time to the matter, for many have been simply cranks. I have a friend who is deeply interested in the subject, who is striving to convert himself into a bird. He has been in the habit of making figures for the student at an anatomical college, and having furnished the counterfeit of a man which could move its arms and legs, he believes that he can make an imitation bird which will carry him to the clouds. He is no nearer success after innumerable experiments than he was when he started, but he is still shooting birds and endeavoring to reproduce their like mechanically."

"Will flying ever become general, in your opinion?"

"I fully expect so. At present it is a novelty, and people will not risk a fall. But see how new inventions become general. Ten years ago you could not have got a lady to venture a ride by automobile, but now see the vast numbers of these vehicles in common use!"

"But the flying motor is going to be a costly luxury?"

"It is not going to be always a luxury, but a contrivance of practical utility. The

steamboat was pretty much a luxury at first, and it was a matter of great expense to run one for a single passenger. But they well repay cost now when with enormous horse-power they carry vast cargoes and a great number of passengers."

SANTOS-DUMONT IN THE BASKET CAR OF HIS AIRSHIP. HE IS JUST SHAKING HANDS WITH THE SECRETARY OF THE AERO CLUB, PARIS, HIS LEFT HAND IS GRASPING THE WHEEL WHICH MOVES THE GREAT RUDDER, AND HE IS READY TO BEGIN HIS FLIGHT.

"Will the flying motor develop on the same lines?"

"That is my belief. We are about to make a considerable advance now. My No. 6 airship had only a six horse-power motor; my No. 7 is being fitted with two motors, each of forty-five horse-power. The increase will, of course, give me greater speed and strength in every way."

"You will need greater lifting power. The weight of the machine when carrying a load will make this absolutely indispensable."

"Yes, but that will not be lacking. I shall still have the balloon for that. I expect that a way will be found of dispensing with the balloon and of relying upon the motors altogether before very long, but until we get that we must make the best use of what we have."

"Do you not find it difficult to maintain the rigidity of the balloon when driving against the wind?"

"No, that is counterbalanced by the interior pressure. Of course I have no framework for the balloon, but the atmospheric pressure brought to bear upon the interior answers. On the day that I rounded the Eiffel Tower the rate of the wind was certified by the meteorological authorities as being eighteen miles an hour. In starting out I had that with me, and did the journey of four miles in eight minutes. Coming back I had to fight against the wind."

"And the speed of your new ship?"

"That should be about forty miles an hour."

"Fuel must be an important consideration."

"Fuel is the only form of ballast I carry. My motors will consume about sixty pounds of petroleum an hour. I shall be able to carry four hundred pounds of petroleum."

"You are going to have a try at St. Paul's?"

"I think I can get round. The only difficulty would be the wires. We have nothing higher than the tram wires in Paris. Of course I could get up here easy enough. I only think of the wires as being nasty things in case of an accident.

"Our automobilists are the men who will achieve important results, I hope. The man who is an expert in the matter of motors is the man who is going to make the best airship. Sir Hiram Maxim and Professor Langley are in the high track for flying, and Mr. Rolls and Mr. Paris Singer are sure to be heard of in the matter."

"You are not afraid of having your patents infringed?"

Has No Secrets.

"I have no patents. I am delighted to tell the little I know to anyone who is interested in the subject. All the work done for me has been carried out in an open shed, and anybody is welcome to have designs and measurements of any contrivance I possess. The more you interest people in aero-navigation, the more likely we are to get practical results."

"And of those practical results you have already assured me you feel certain."

"I feel confident that we shall before long see enormous developments in aero-navigation. With increased horse-power—and if we can have ninety-horse-power, why not a thousand?—we shall have airships capable of carrying a number of people as safely as do the big passenger steamers. Why, in ten years I firmly expect that there will be a line of airships crossing the Atlantic Ocean at such a rate of speed and with such a degree of comfort that the present day ocean liners, magnificent as they are, will seem fitted only for freight carriers or people in search of the health, which comes from making a journey on the sea.

"The possibilities of the airship have never been dreamed of. Three years ago if any one had said that a man would be able to sail an aerial vessel to and fro without regard to the wind, he would have been called a fool—yet to-day I have accomplished such a feat, and this, I don't hesitate to say, is but the beginning of what I will do. But do not misunderstand me and think that I am considering only myself. Nothing is patented. I make everyone free to use for his own, any idea or piece of mechanism in the "Santos-Dumont," as I call my ship.

One Hundred Miles an Hour.

"The speed that airships will achieve in time is so nearly illimitable that I do not care to make any predictions at all regarding it, except that I think one hundred miles an hour will be considered a merely ordinary speed. As far as the danger of the airship is concerned, I do not think it is more hazardous than traveling by rail or steamer. In my airship it is almost impossible to fall swiftly because of the construction.

"My airship No. 7 is between 160 and 170 feet long and about 25 feet in diameter. These, of course, are the balloon part dimensions. The motor is of 45 horse-power and weighs 270 pounds. This ship I am convinced will carry at least five persons and maybe more. I have

never taken any one into the air with me (except, of course, in balloons)."

The air of confidence on the part of the famous inventor was not disturbed by any questions, however puzzling. Every objection had been well thought out and fully anticipated.

"Anyone who has followed the history of the dirigible balloon," he continued, "and observes my experiments cannot fail to see progress has been made. To the illustrious Mongolfier, the inventor of balloons, the world is under everlasting obligations. Curiously enough, even scientific men then thought that aerial navigation was a simple problem. They thought that an airship could be rowed like a boat. Others took to the winged theory, thinking that the flight of the bird was the key to the question.

SANTOS-DUMONT ROUNDING THE EIFFEL TOWER IN HIS AIRSHIP.

Giffard was the first to put a machine in a balloon and to elongate it.

"France has done fairly well in this branch of science. The Renard brothers, however, have really never accomplished much as far as the public knows. Roze and others are now giving much attention to aerial navigation in France. Zeppelin made an effort over Lake Constance to navigate the air. Success did not smile upon him. Germany is at a standstill as far as aerial navigation is concerned.

Russian Inventors.

"Russia is exceedingly interested in the question, and the government has scientific men employed to study it in all its details. Russia, however, looks upon it chiefly in the light of military utility. The spirit of aerial navigation is fully awakened in England. I have been asked by many Englishmen to build airships, but I have been compelled to refuse, as this is not my calling. You will excuse me for saying that Brazil,my own country, is easily the first in aerial navigation. I look forward with pleasurable interest to what the United States will do for this new science."

It is a matter of record that M. Santos-Dumont has demonstrated his ability to steer his machine by driving it twice against the wind from the Parc d'Aerostation in Paris to the Eiffel Tower, a distance of four and a half miles. He made two successful ascents at Monte Carlo, guiding his machine against the wind. These experiments ended in a dangerous accident. His motor got out of order and his machine fell into the sea, where he was rescued by the Prince of Monaco's yacht. He holds that a man who strives to solve the problem of air navigation must be willing to risk his life.

Not only M. Santos-Dumont, but the whole body of airship inventors throughout the world are profoundly interested in the subject. France is the leading country in practical aerial navigation, but Germany,England and other countries are giving much attention to the subject. One of the most notable air vehicles is the balloon "La France," the invention of the brothers Colonel and Major Renard and of Major Krebs, of the French army. It is claimed that this machine in 1884 fulfilled the conditions established for the Deutsch prize, which Santos-Dumont won in Paris. Motors were at that time only in a rudimentary stage of development. Many Frenchmen declare that if "La France"could have taken part in this competition it would incontestably have won the prize of twenty thousand dollars. Colonel Renard was occupied with his military duties and was absolutely prevented from taking part.

Conquest of the Air.

He formulated the following conditions which he considers indispensable to a thoroughly useful airship, and which he thinks should be kept in mind :

"The conquest of the air will be practically assured only when we can construct a dirigible balloon having a speed of forty-one feet per second, or thirty-two miles an hour, and can keep up this speed for ten or twelve hours."

The brothers Renard, before attempting to solve the problem of flight in a practical manner, made a thorough study

of the theoretical and scientific features of the problem. They came to the conclusion that the greatest difficulty to be overcome is to keep the balloon in a state of equilibrium at the same height or at the same place. This is the problem of the vertical steering of the balloon, the solution of which will perhaps be slower than that of horizontal steering.

Swift Flyers.

With the present type of motor these officers have been able to give "La France" a maximum speed of 22 feet 9 inches per second, in place of the 41 feet aimed at. It is to be remembered that Santos-Dumont, with his latest petroleum motors of 1901, has not been able to get more than 26 feet per second. Further, it is pointed out that "La France," from the point of view of rigidity and longitudinal stability, is immeasurably superior to the Santos-Dumont machine, and has never had any of those accidents which have so often endangered the life of the daring Brazilian aeronaut. On the other hand, Santos-Dumont and his friends attach no value to the Renard balloon.

"La France" is 162 feet in length by 27 feet in diameter. This remarkable balloon is not symmetrical in shape. The inventors have placed the frame forward of the central section, thus giving it a form similar to that of the very swift species of fish. In other words, the balloon is large at its forward end and tapers away to a point behind. The motor of "La France" is a Gramme electro-dynamic machine of eight horse-power, weighing about 200 pounds. It is worked by a battery weighing 800 pounds, which can now be replaced by a much lighter one. The screw propeller is placed in front. Colonel Renard thus describes his first successful ascension :

"As soon as we had reached the wooded heights surrounding the valley of Calais, we set the screw in motion, and had the satisfaction of finding the balloon obey immediately, and follow all the indications of the rudder. We felt that we were absolutely masters of our course, and that we could go through the atmosphere in every direction as easily as a steam launch on the surface of a smooth lake. After having reached Villacoublay, we succeeded in turning round and aimed at the lawn from which we started. This lawn, 200 feet wide by 400 feet long, is surrounded by trees, by high buildings and bordered by a pond of several acres. We cleared the walls of the Park of Calais, and soon saw our landing place, 900 feet below us. The propeller was slowed down and the opening of a valve started us on our downward course. The rudder kept the balloon absolutely in the same vertical line, and we landed safely on the exact spot from which we started."

French Navy's Balloon.

Colonel Renard made a series of trips in which five times out of seven he succeeded in steering his balloon back to the starting point. The French Navy Department has obtained a remarkable balloon for use on its ships. This can either be used as a captive balloon attached to the deck of a warship or sent away on a scouting expedition. It is a remarkable fact that from a balloon at a certain height, an observer can see the bottom of the ocean, while it is quite invisible to one on

the deck of a ship. The higher one goes, up to a certain point, the more plainly can the bed of the ocean be seen.

Although Count Zeppelin's dirigible balloon came to grief and almost ruined its inventor, it is nevertheless considered a very remarkable production, and contains some excellent ideas. This balloon is an immense cigar shaped construction of aluminum, about 325 feet in length by 39 in diameter, and contains within the outer envelope no less than seventeen separate balloons, of which the total capacity is 385,000 cubic feet. The apparatus weighs over 8000 pounds, and possesses an ascending force of over 24,000 pounds. It carries two cars joined together by a bridge, and carrying each a motor working two screws. This airship is built to carry ten passengers.

The first trial, which took place on July 2nd, 1900, was very successful. The airship described a wide semicircle and returned a few yards from its point of departure in the bay on the royal estate of Manzell, on the shore of Lake Constance. The speed attained, 20½ feet per second, was not remarkable. At a subsequent test in the same place the machine was wrecked.

A New Design.

One of the most extraordinary flying machines in appearance is that invented by Roze. It is remarkable in having twin cigar-shaped balloons attached to it. It is shown here in the illustration about to start on a railway from its shed at Argenteuil, near Paris. Roze belongs to what is known as the "heavier than air" school of aerial navigators. His machine is called an aviator. It is diametrically opposed in principle to the machines of Renard and Santos-Dumont. It consists, roughly speaking, of two cigar-shaped balloons, 146 feet long, joined together by a rigid brace of aluminum, which sustains the car.

Plan of the Ship.

The latter is divided into two floors. The upper is the machine room, the lower one a comfortable cabin, where four persons can sit at ease. The pilot sits in the forward part of this cabin and directs the engineer by means of a speaking tube. The apparatus all ready to start should weigh about 176 pounds, including the passengers and provisions. But at the time of its first trial this weight was greatly increased on account of mistakes in the varnishing. The trials which have taken place at Argenteuil are not considered final.

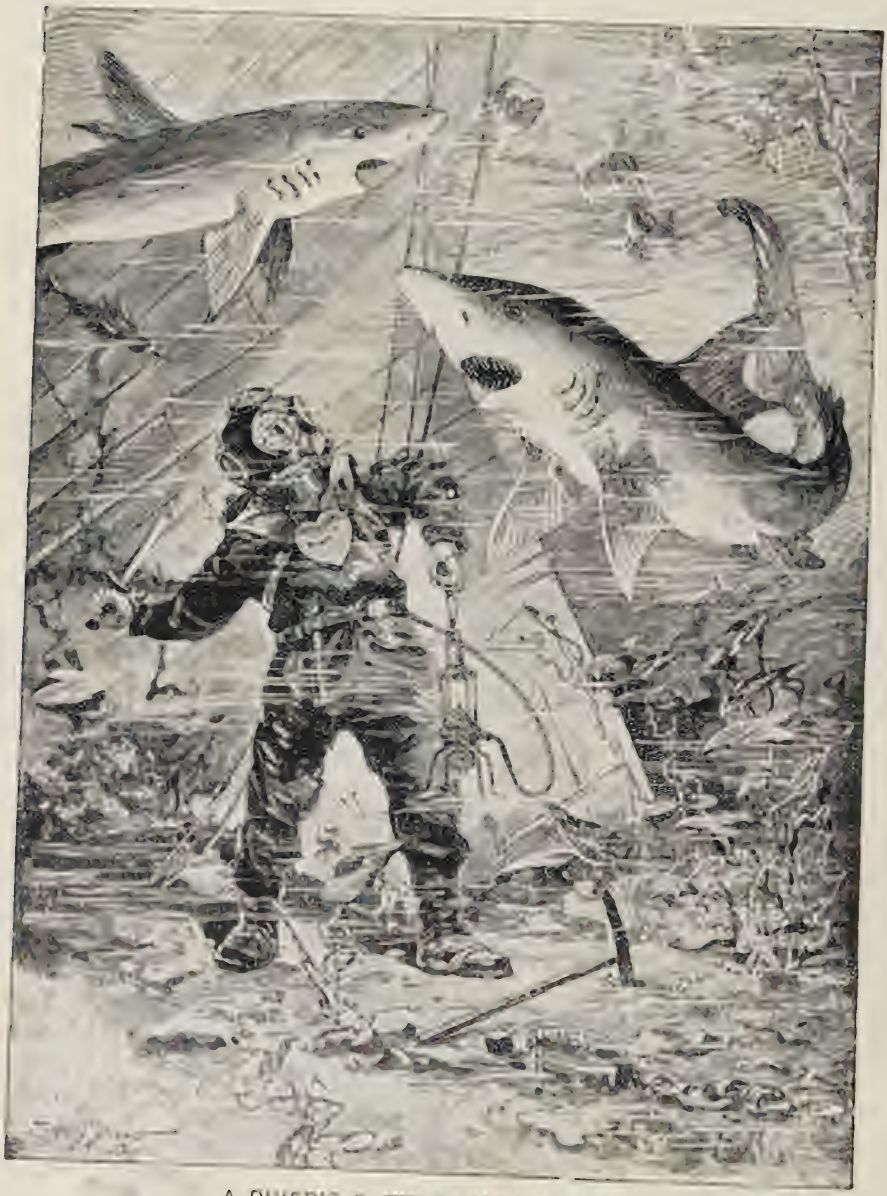
The ascension was made by means of horizontal screws making 300 revolutions a minute. Having arrived at a certain height, the machine is supposed to maintain it by means of a great parachute composed of parallel plates, the opening up of which occurs automatically. To progress horizontally the airship is supplied with screw propellers, worked by the same motor as the ascending propellers.

The balloons are filled with hydrogen. They are protected against being knocked out of shape by a skeleton of aluminum tubes. Each one is divided into five gas-tight compartments, which ensures the equilibrium and stability of the machine, and provides an important safeguard in case of bursting. The whole apparatus will float in the water. So far Roze has

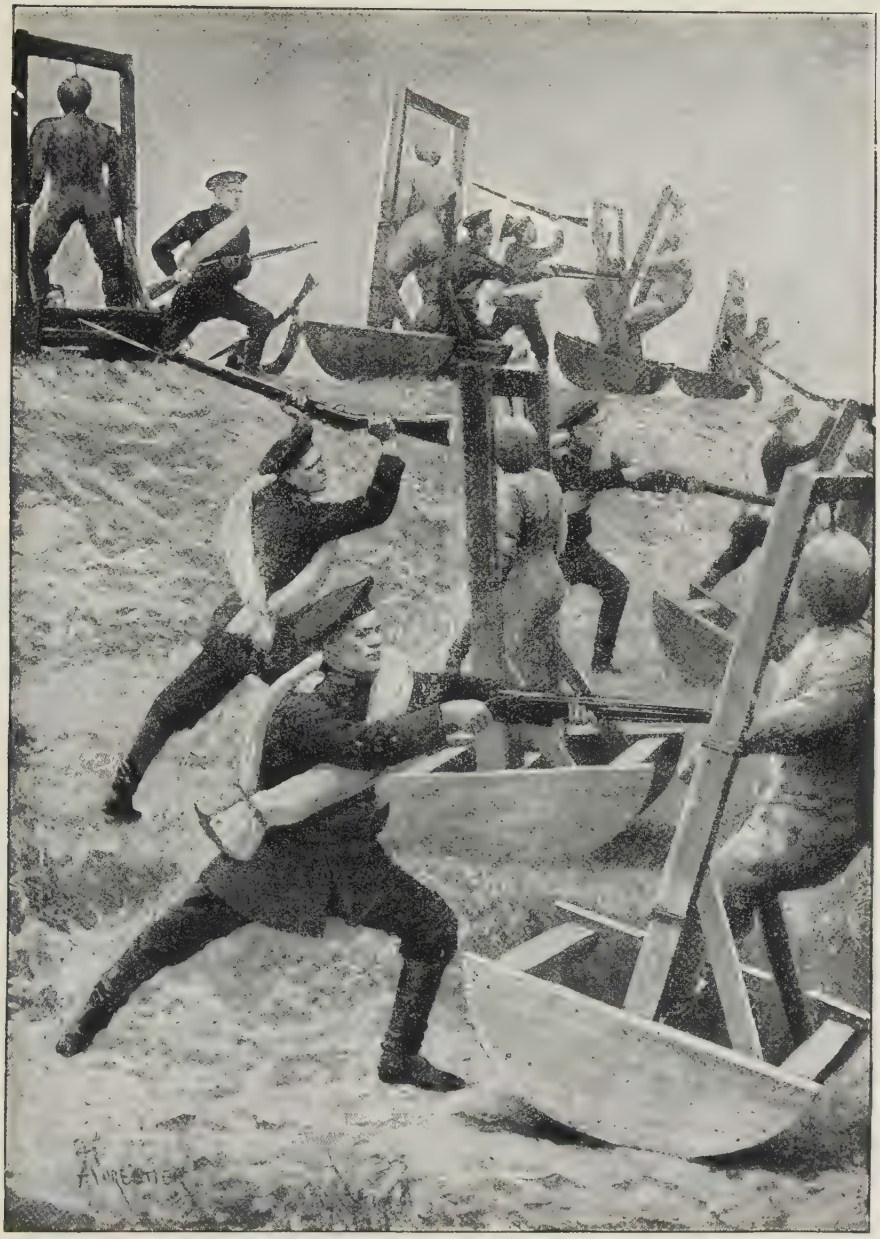
BIG TREE NEAR UXACO, MEXICO

SCENE IN THE COURTYARD OF THE MONASTERY AT HIMIS ON THE OCCASION OF THE ANNUAL SPRING FETE OR CARNIVAL

THIS GROTESQUE FESTIVAL TAKES PLACE ALL OVER THE MYSTERIOUS LAND OF THIBET. IT IS ORDERED BY THE HEAD OF THE BUDDHIST HIERARCHY, WHO IS SUPPOSED TO BE THE LIVING INCARNATION OF BUDDHA

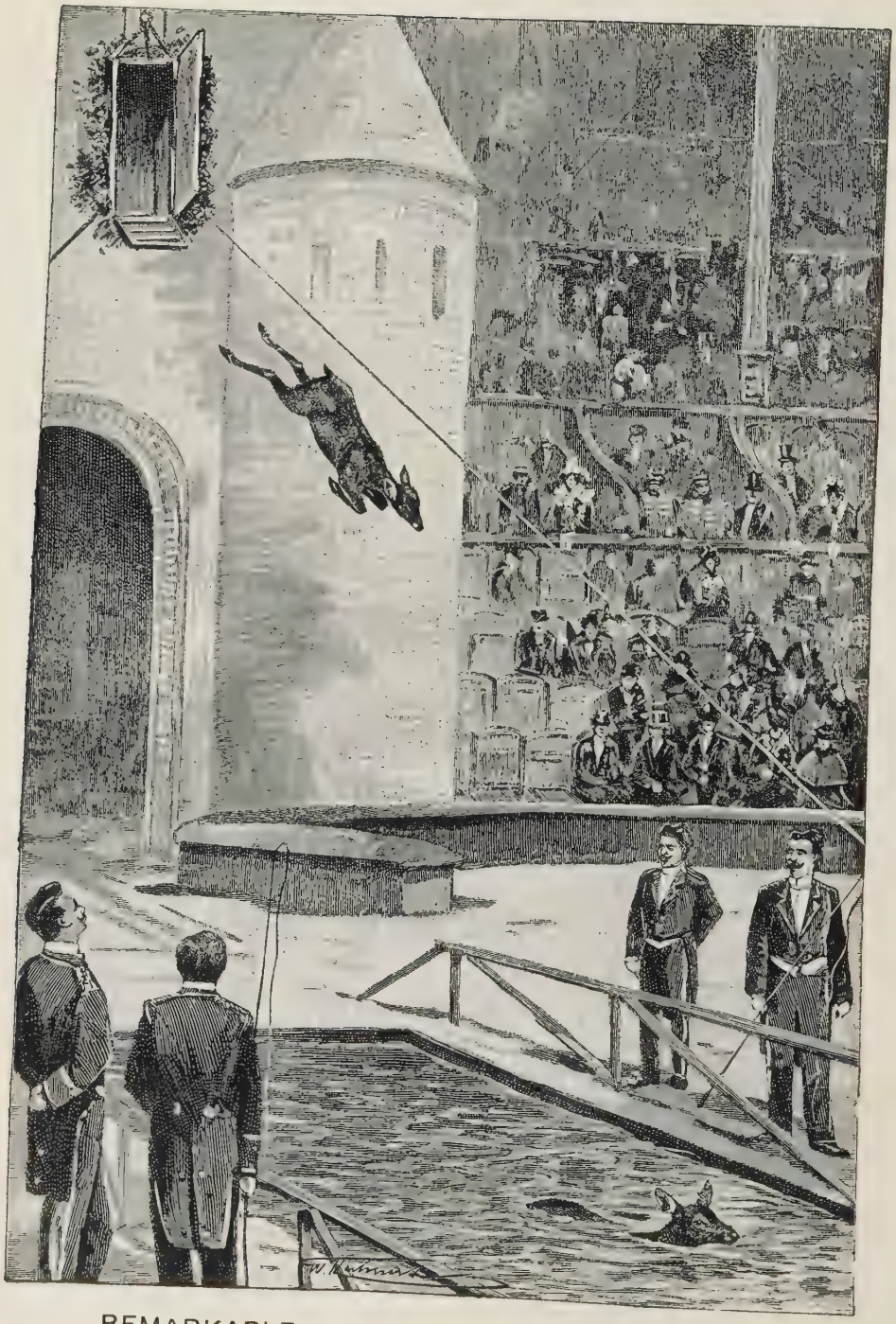


A DIVER'S BATTLE WITH SHARKS



BAYONET EXERCISE WITH OSCILLATING DUMMIES
IN THE RUSSIAN ARMY

THE DUMMIES ARE PLACED ON THE TOP OF ENTRENCHMENTS WHICH THE SOLDIERS SCALE. THE MEN THEN GO DOWN THE OTHER SIDE AND THE ATTACK IS REPEATED UPON THE SILENT VICTIMS



REMARKABLE LEAP OF DIVING ANTELOPES

IMPERIAL PROCESSION PASSING THROUGH THE STREETS OF PEKIN, CHINA,
ON ITS WAY TO THE FORBIDDEN CITY

THE WONDERFUL BANYAN TREE

THE BRANCHES OF THIS REMARKABLE TREE DESCENDING TO THE GROUND TAKE ROOT AND SOON BECOME NEW STEMS

old-fashioned method of discharging gas for the purpose of descending, and will thus be able to remain in the air for a much longer time.

The photograph shows the six propellers, each with six blades, each pair driven by a 45 horse-power petrol motor. The petrol tanks may be noticed arranged along the sides of the car framework, which is constructed of steel tubing, and at each end of the car is a water-tank, designed to keep the "deck" level under all circumstances. The three sets of aeroplanes are seen at equal distances apart in the car.

Dr. Barton's theory is that in time we shall be able to dispense with the "gas-bag" altogether, and herein he is probably right, for with the compression of tremendous motor-power into smaller and smaller space, we shall arrive at a time when, with irresistible motors and the lightest possible engines, we shall be able to go "humming" up in the air after the manner of the stag-beetle, or the flight of a graceful swallow.

Meets With an Accident.

Santos-Dumont, is, of course, easily the leading air navigator of France. The following description by an eye-witness of the exciting collapse of his machine, No. 6, off Monte Carlo, will be of interest:

"Attwo o'clock in the afternoon Santos-Dumont, who had made a bet with a friend that he would take his machine to the pigeon-shooting ground at Monte Carlo, proceeded to make his preliminary examination of the machinery and found considerable difficulty in making the motor work properly. At 2.45 the doors of the shed opened and the "Santos-Dumont No, 6," slipped out and rose into the sunny blue sky.

Then, obedient to the action of the rudder, the aerial skiff sped along for a time at a height of 150 feet above the water. Struck by a violent squall from the west the airship was turned toward the houses on the cliff at Monte Carlo on which it seemed certain that Santos-Dumont would be crushed. With a masterly turn of the rudder the young aeronaut turned his vessel once more toward the open sea.

Fell Straight Into the Sea.

"It was at the entrance of the bay that the accident occurred. Suddenly we saw the airship turn to one side at right angles and become shaken by violent oscillations while the point turned up to the sky and the guide rope left the water.

"Then the machine, with its daring pilot clinging to his car fell straight down into the sea and the car sank out of sight. Santos-Dumont was lost, we all thought! But after a moment of stupor people rushed to the assistance of the aeronaut from all sides. Among the first to reach him were the steam launches belonging to the Prince of Monaco and Mr. Eugene Higgins. An immense feeling of relief swept over the numerous crowd that watched the accident when they saw that the daring aernoaut was safe.

"The 'Santos-Dumont No.6,' floated on the surface of the water like an enormous whale. It was hitched on by a cable to the stern of the Prince's yacht, which then started to tow it, but the motion of the yacht tore open the silk envelope and broke up the light bamboo framework while the motor went straight to the bottom of the bay. This was eventually re-

covered and was the only part of the machine fit for use."

When the airship invented by Count Zeppelin travelled from Friedrichshafen to Immenstadt (a distance of thirty-five miles) all the world wondered. The Count is a general in the German army. He went through the American Civil War in a private capacity, and his first ascent was in a balloon belonging to the Federal army. He fought in the Franco-German war, distinguishing himself for his reconnaissances. Then he was employed on the staff of the King of Wurtemberg, and in this capacity he attended several State functions in England. He has spent $125,000 in aerial experiments, and got a syndicate with $200,000 to back him, no less a personage than Helmholtz (who at first did not believe in the invention) examining his claims.

Framework and Netting.

The framework of his ship consits of twenty-four bands of aluminum seven inches apart. Over this framework is stretched hempen netting, both to the inside and outside of the girders, so that there are two layers of netting. The framework is subdivided by sixteen network partitions, in each of which a gas bag of corresponding shape is inserted, so that altogether there are seventeen balloons. Outside all there is a cover of waterproof silk.

Under almost the entire length of the vessel runs a gangway two feet wide of aluminum. Two pairs of propellers, each being a four-bladed screw, about 3 feet 6 inches in diameter, are arranged, one pair near the forepart and one near the afterpart of the ship. The inflation of the balloon is done by means of 2600 tubes of compressed gas.

The airship, which was built at Lake Constance, is 420 feet long, 37 inches in diameter, has a capacity of 400,000 square feet, and weighs 7260 pounds. It is propelled by two 15 horse-power Daimler motors, fixed on cars which stand on a gangway beneath the "ship."

A Big Raft.

The floating stable of Count Zeppelin's flying machine consits of a huge raft nearly 500 feet long, on which a great wooden house has been built, and is said to have cost $50,000. The advantages of such a floating stable are many. An open space of water all round, without trees or buildings to interfere, is most desirable in starting the machine, and in the event of an accidental precipitation no very serious damage is likely to come to either man or machine. The great house-boat is in reality a floating dock, containing within it a long raft, on which the balloon rests. When the start is to be made this raft is towed out of the house and there is the balloon all ready for ascent. Near by is a floating shed containing a number of pontoons to carry the gas tube for inflation. Then there is the boat-house to accommodate several oil launches and other boats, while on shore some great sheds are erected, wherein the balloons are prepared and varnished, and the usual offices and draughtsmen's rooms complete the establishment.

All sorts, sizes and shapes of airships have sprung into existence in the eager competition of inventors to furnish a practical vehicle for aerial navigation. One

of the most curious is the machine designed by the inventor, Mr. George Louis Outram Davidson, of the Junior Carlton Club, who is a member of a well-known Scots family, The machine differs from nearly all other attempts at the solution of the great problem of mechanical flight in that it does not rely upon obtaining its forward motion by pushing itself from behind, as a steamship does in water, nor is it in any way a balloon.

A UNIQUE FLYING MACHINE.

On each side of the machine there are two vast umbrella-looking structures. These act as lifters, gripping the air as they revolve when driven by the engines situated low down in the body of the car. Using the air as a fulcrum, they give a continuous and almost vertical upward thrust, greater than the absolutely vertical downward pull continuously exerted by gravity. Two forces result in the forward motion of the whole structure, similar to the motion imparted to an arrow driven through the air by the pull of the string drawn in almost opposite directions by each end of the bow. The speed will increase so long as the angle of lift is kept forward of the vertical, and this angle, although it can be instantaneously altered at will, is maintained automatically in the position for which it is set, the tail being actuated by this automatic gear.

The force of the upward thrust is regulated by the number of revolutions at which the lifters are driven. The downward pull invariably remains the same; that is, equal to the absolute weight of the entire structure. When in the air the lifters may be stopped if desired, and the whole structure then becomes a glider, the angle of glide being governed automatically as before mentioned. Direction is regulated by a vertical forward rudder or beak governed by hand, which cuts the air and thus turns the car to right or left. The body of the structure will be

fitted with saloons and other passenger accommodation, and although in appearance it would seem weighty it is really not so, the greater part being hollow. If properly constructed the flying-machine of the future cannot possibly be overturned unless by a whirlwind, and will be the safest, swiftest, and most convenient and pleasant means of traveling the world has yet experienced.

"WHAT NUMBER PLEASE?"

Answering Calls at a Telephone Exchange—How the Connections are Made—Multiple Switchboard.

EACH telephone girl sits in front of her section of the new multiple switchboard, and when the lamp attached to your wire glows, with her gloved hand she fits a metal plug into the hole to which your number is attached. She then asks you through the mouthpiece, which hangs in front of her, "Number, please?" The telephone girl receives the required number through the ear piece, which rests against one ear and places another plug in the required hole. Every subscriber's number is in front of each girl for answering purposes, but only a few subscribers' calls go to the same girl, and these are adjusted so that a fair share of work goes to each.

Threading up the Wires on the Intermediate Distributing Frame.

When the sorted wires come up from the basement before going to the operator's switchboard they are arranged on a "distributing frame," to allow the switchboard manager to allot a fair share of wires to each operator. Without this arrangement one girl might have fifty busy subscribers who were perpetually calling up numbers, while the next girl had scarcely any work to do. By running the numbers horizontally on this side of the frame and perpendicularly on the other, it is possible to easily rearrange the wires as the amount of work demands.

Striking Features of the New System of Telephoning.

The most striking feature of the new method of arranging through communication between two subscribers is the silence and ease with which the operation is now conducted. The multiplying of subscribers created difficulties in the old exchanges which rendered the work anything but a matter of ease to the telephone girl or to the subscriber. The little indicating discs could not be placed, owing to their size, in the compact arrangement now possible with the little

glow lamps, which are of the same diameter as a lead pencil.

When the conversation is over, the fact is indicated by two little lamps automatically and silently glowing. The new telephone exchanges, in fact, open up a pleasing vista of an improved civilization, in which the nerve-destroying noises which have hitherto characterized our mechanical aids will be eliminated. The absence of the great aerial forest of wires above the exchange is another striking change. No snow storms can now damage the wires in their snugly-laid ducts.

ANSWERING CALLS AT A TELEPHONE EXCHANGE.

The old overhead wire will, however, continue in use for long distances, owing to electrical difficulties. There are no longer any local batteries on subscribers' premises. The current is all supplied by the new "common battery" system in the basement of the exchange, which furnishes all the power needed.

SUBMARINE BOATS

Fifteen Hours at the Bottom of the Sea—New Factor in Naval Warfare—Vessels that Sink or Rise at Command of the Propeller.

WITH the severest gale and highest tide Peconic Bay had seen in twenty years, battering ships and docks above, the submarine torpedo boat "Fulton" rested for fifteen hours on the bottom, far below the disturbance. For the first time in the history of submarine navigation it was demonstrated by actual test that it is possible for men to breathe and work unhindered deep down in the ocean for almost an indefinite length of time. In the fifteen hours the men in the "Fulton" did not use an inch of the compressed air they took below with them, but lived without the slightest inconvenience upon the air in the vessel itself when it sank.

In the boat were Rear Admiral John Lowe, U. S. N., (retired); Lieutenant Arthur MacArthur, in command of the torpedo boat "Winslow"; Captain Cable, of the Holland Torpedo Boat Company, and five employees of the works at New Suffolk, where the test was made. On shore were Naval Constructor Spears, who is supervising the construction of sister ships to the "Fulton" at the Nixon ship yards; Mr. Frost, the manager of the Holland company, and a number of newspaper correspondents, who kept watch on the guide mast of the submerged vessel.

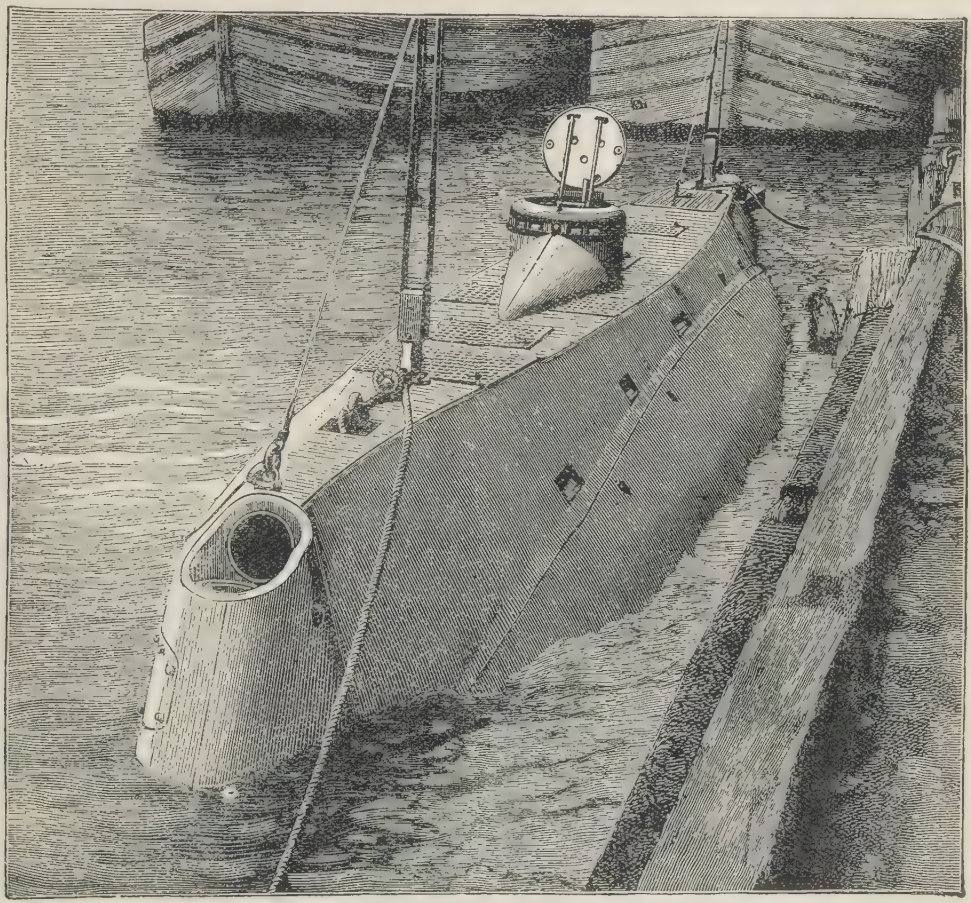
The test was made to prove the inventor's contention that breathing facilities were not a bar to the utility of this type of war engine. The unexpected storm brought accidentally a still better demonstration. According to the naval officers, its behavior on the bottom of the bay, and that of the still incomplete "Adder," lying half submerged near by, proved it of the most seaworthy type of vessel. While the high tide and waves were dashing over the "Winslow," and the torpedo boat was tugging at the lines and anchors which held it, the masts of the "Fulton" and the "Adder," barely visible through the storm, only swayed gently, as though the boats were rocking in a mild swell.

Though the force of the storm tore out the sides of the basin in front of the works, wrenched the piling, drove one scallop schooner through a board fence and beached two others, the men below in the "Fulton" did not feel a tremor. They slept and ate and played cards, while those on the docks and vessels

above watched anxiously for parting lines and collapsing breakwaters. It was a thorough test of what the new boats of this type can do in the way of weathering a storm and hiding from an enemy.

Shortly before ten o'clock in the morning the watchers on shore saw the masts of the "Fulton" suddenly shoot upward. A second later the conning tower popped into view, and then, slower and more soberly, the curving sides of the hull pushed up out of the bay. Workmen and the townspeople of New Suffolk who were not already on the scene rushed to the basin, and were in time to see Captain Cable throw back the lid of the tower and stick his head out.

"If I'd have known it was like this I wouldn't have come up," he said. And it was some time before he could be induced to talk about anything else than the advantages of the weather at the bottom of the bay. When they did express themselves, all concerned spoke in the highest terms of the result of the test. There was no longer any doubt that the boat would do admirably all that was expected of it.



HOLLAND SUB-MARINE BOAT IN HARBOR.

"I was extremely critical," said Rear Admiral Lowe, who had been in the engine rooms of warships since 1861, "and I was not able to detect the slightest unfavorable feature. We could have stayed down for four or five days if we had taken enough food with us. It is an immense success."

"She is a success, of course," said Naval Constructor Spears. "We expected that. The test, however, proved her seaworthiness. She is safer in a storm than an ocean liner. I would be willing to risk taking her across the Sound to-day, rough as it is, and I wouldn't try it with many boats of her size. It is the most seaworthy type of craft afloat."

All That Was Claimed.

In connection with this statement, it is significant that the "Winslow" was under orders to sail for Newport at noon the day before. The weather was so rough, however, that Lieutenant MacArthur would not risk his vessel in crossing the Sound, and remained in the bay for several days.

In speaking of the test Lieutenant MacArthur said: "The test has demonstrated that these vessels are all that has been claimed for them. Men can live in them below as long as food and air last—almost as long as they like, in fact. They are seaworthy, invisible and easily handled. I have a crew for the 'Adder,' here now, and they are all anxious to get aboard of her."

The men at the works were, of course, jubilant over the success of the test. Fifteen hours is by far the longest time a submarine boat has ever remained completely submerged—except those that stayed down for good. The French tests were for much briefer periods, and the longest previous experience below for a Holland boat was three and a half hours. The test was not made under headway, as the previous submersion had been, but no such test will be required in actual service. Rear Admiral Lowe and Captain Cable, however, assert that it could have been done that way just as well, as the working of the engines would not change the living conditions in the slightest.

The rise of the "Fulton" was extremely rapid when Captain Cable released the fifteen tons of water ballast which weighted her to the bottom. Usually the water is forced from the compartments by means of pumps, but in this instance one of the unused flasks of compressed air was turned into the compartment and the water forced out with a rush in a few minutes.

Boat Sank Out of Sight.

It was seven o'clock in the evening when Captain Cable pulled the lid of the conning tower down over his head and screwed it fast above him and his companions down below. The crew opened the ports and the water rushed into the compartments, while the "Fulton" slowly settled with the weight. When it rested on the bottom there was six feet of water above the windows of the conning tower. At low tide it was expected that these would be again above water, but as they are airtight it would make no difference in the test. The extremely high tide, however, kept the boat buried under nearly ten feet of water on an average, and only its masts were visible.

On board the "Winslow" the crew and the men who were to man the "Adder," quartered there ranged themselves along the deck as the strange craft sank. One of them said something about "a new style of coffin." It was dark and raining, and the electric light made the picture even more weird. Almost as soon as the boat rested on the bottom the storm arose. Sheltered in the cosy cabins of Mr. Frost's steam yacht, the "Geroldi," tied beside the pier, the watchers stared out at the water and the storm. They could not get the idea out of their minds that there were eight men, who were their friends, down under the water outside, with no way to call for help should they need it.

Far Below the Storm.

During the night the wind and the tide piled the water high along the docks and basin. It rose above the pier at which the yacht was tied and swept up the village street for fifty yards. It undermined the docks and tossed about the 1,500 tons of stone which guard the basin. At daybreak spray was dashing over the "Winslow" and the vessels in the basin were straining at the anchor chains and lines which held them. The "Adder" was swaying gently and the masts of the "Fulton" were invisible, but no fear was felt for her safety. About 8 o'clock the water began to recede and the watchers wading about on the docks to the full limit of their hip boots saw the tops of the spars again.

When the fifteen hours had expired, save for a few minutes, the "Fulton" returned to an even wetter world and was quickly hauled ashore by lines. Captain Cable ventured his opinion as to the weather and then quickly clambered from the tower, followed by his guests and crew. The boat was quickly inspected and found to be in as perfect condition as when she sank.

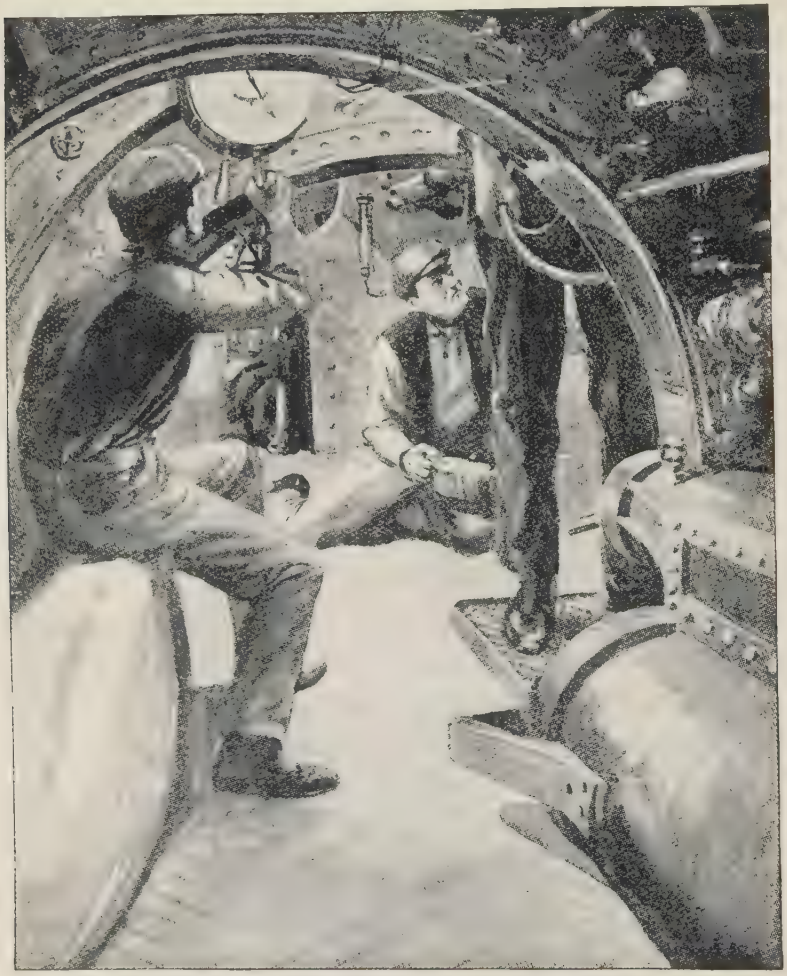
On the "Winslow" the deck was again crowded, in spite of the rain, and the workmen, townspeople and watchers on the yacht and docks, together with the white-coated jackies, peering from beneath gun shields and every possible shelter, made a ring of spectators about the watery arena. In the afternoon there was luncheon on board the "Geroldi" in honor of the success of the test. Then Lieutenant MacArthur returned to the "Winslow," Rear Admiral Lowe to his home in Connecticut, and Naval Constructor Spears to his duties at Elizabethport.

The Admiral's Report.

The naval officers were present in an unofficial capacity, but all as interested in the test as if they were to write an official report. Rear Admiral Lowe has made a close study of submarine boats, and Mr. Spears was in charge of the construction of the five new boats for our navy exactly like this at Elizabethport. They could therefore speak from an intimate knowledge of the conditions. In speaking of the test and what it showed in naval methods Rear Admiral Lowe said:—

"The 'Fulton' has shown what could be done in case of need in actual warfare in many instances. Suppose she had made an attack upon a hostile fleet, had discharged all of her torpedoes and been discovered. She is absolutely without

means of defence except her powers of disappearance. She might be surrounded and pursued so closely that it would be dangerous to attempt to run away, even under water. In that case she need only drop quietly to the bottom and rest there, without noise or effort or anything to betray her presence. She can remain there for four or five days, and in case of emergency i the food holds out for a week. Her escape then would be almost certain. In another case, for repairing machinery, shifting torpedoes or anything else which requires stopping the engines, or quiet, she could find a secure dock at any time on the bottom, except in very deep water.



INTERIOR OF A SUBMARINE BOAT.

"Her speed is not great, only nine knots on the surface and seven knots when running submerged, but the time has gone by when speed is the first requisite of a torpedo boat. The battles of the Spanish war showed that they cannot hope to get within striking distance after they have been sighted. It was an advantage before the perfection of the heavy calibre rapid fire guns. The torpedo attack of the future must depend not upon speed, but upon concealment, either by darkness or by water."

"Is not the submarine boat in great danger of being run down at sea?" he was asked, and answered promptly:

"No more so than any other vessel," he replied. "They are not supposed to run submerged unless they mean business, and when they go in for that they expect danger, like any one else. The only vessel which could run one down,

except by accident, is a torpedo boat, and the shell of a submarine vessel, built to withstand the pressure of water, is so much stronger than that of the surface craft that it would probably be dangerous to ram."

Those who went below were closely questioned as to the quality of the air, and all insisted that they were unable to detect the slightest difference between it and that they breathed in everyday life. Even the sudden change to out of doors breathing gave no strange sensation. The "Fulton" was built by the Holland Company, without any purchaser in view. The idea was to have a perfect model entirely at their disposal, and the plans contemplated, exhibiting her before several commissions of naval officers of foreign Powers. The inventor was eager to prove by tests the success of his boat.

The Boat Described.

We take from a prominent journal the following:

"The 'Adder,' launched at Elizabethport, New Jersey, is 6 feet 4 inches in length, 11 feet 9 inches in the beam, and draws 8 feet 10 inches of water. The main motor is electric, giving the vessel submerged a speed of seven knots per hour for four hours. Her armament consist of one tube, through which five Whitehead torpedoes discharge, each torpedo being 11 feet 8 inches long. In diving, to conform to the requirements, the boat must be brought to an awash condition with only the conning tower parts above water, then a dive at a small angle until the proper depth is reached. After the discharge of the torpedo from the fixed bow-tube the compensation for the weight of the torpedo expended must be automatic and instantaneous.

Provision is made for quick rising and diving for observations, the time of appearance of the conning tower above water being dependent on the skill of the navigator. At the end of the submerged run a service torpedo will be discharged, which must strike a target 150 feet long by 16 feet deep, the upper edge of the target being awash and placed at right angles to the course. During the submerged run the boat must not come to the surface more than three times from the time of starting until the discharge of the torpedo, the duration of each appearance not to exceed one minute. Suitable masts are provided for observation of the boat's movements while submerged."

Out of Sight.

Most unusual tests were made of the submarine boat "Fulton," off Suffolk, L. I., when for the first time a torpedo was fired from her bow while she was submerged and going at full speed. The demonstration was highly successful and was witnessed by Commander V. Geelnuyden, of the Royal Norwegian Navy, on the tug convoy "Kelpie."

"Hi there, captain, we're going under for a time now; watch for us a mile away." Captain F. T. Cable, of the new Holland boat, waved his hand. The hatch was closed over the heads of the seven men who formed the crew of the marvelous submarine boat. In less time than it takes to tell it the "Fulton" was out of sight, leaving only a flagstaff sticking above her back to indicate where she was and what she was doing. In less than a minute this flagstaff had gone

down until only a foot and a half of it showed above the water, and then the "Fulton," submerged eleven feet under the sea, began a mile run.

A Vital Test.

With nothing but a compass to direct him and the mathematical calculation of the propeller revolutions to tell how far he traveled, Captain Cable and his men started forth for the test of the "Fulton," the test that was to tell the decisive story of the boat's usefulness as a means of defense against invading fleets. It was proposed that the boat should travel a mile submerged, then fire a torpedo at an imaginary warship on a straight line, rising to the surface to allow the crew to see whether the shot had taken effect, and dive back to the bottom of the sea, and keep on fighting with the enemy in this manner until her prowess as a fighter was clearly established. The test was of vital importance, because it was the first time the "Fulton" had been made to fire a torpedo running under water, and the first time she had been made to show how expeditious she was in diving and coming to the surface again.

The first thing for her to do according to the programme was to run five miles on the surface with her gasoline engines in play. She accomplished this, and the next thing was to turn about, trim for action, dive and run a mile submerged ten feet, bob up again and fire a torpedo, then dive and rise alternately to show how rapidly she could appear and disappear.

After running the five miles the "Fulton" was in the act of turning when Captain Cable ordered her cleared for submersion. The ventilators were taken down by a member of the crew, and the captain went into the hatch to start "trimming." The boat had been bounding through the water with her head tilted slightly above her stern. "Trimming" means leveling the boat for submersion by letting quantities of water into certain tanks underneath. Crossing the line at 9.15 she stopped and trimmed. The conning tower was closed at 9.25, and at 9.49 she had turned about and entered the course, diving immediately. It required seven seconds to get under the water, this being longer than usual, it was explained because of new machinery.

Torpedo Fired Under Water.

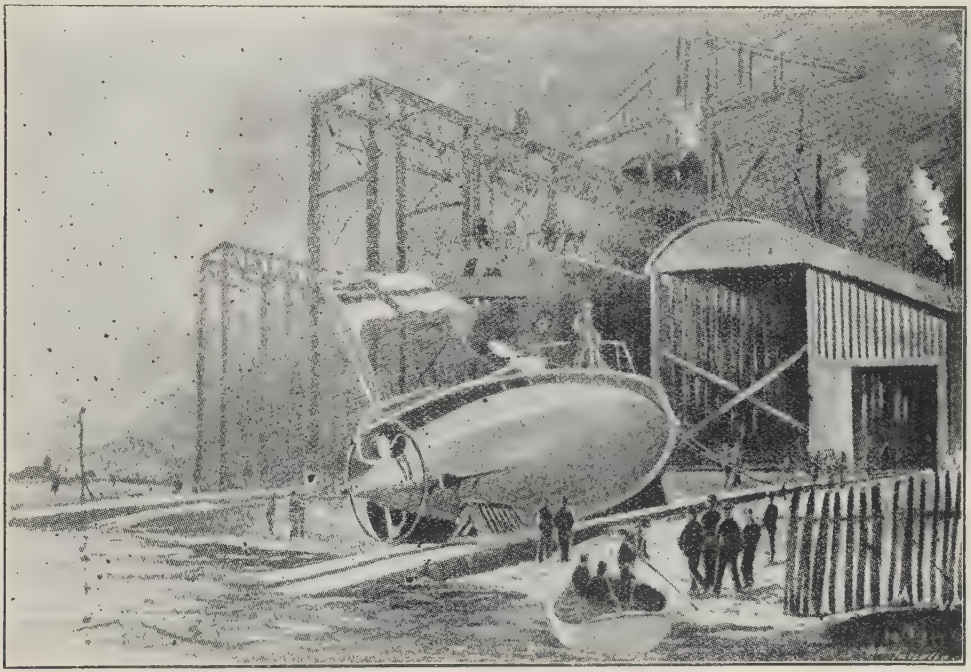
For ten minutes and thirty seconds the boat was lost to sight. The steering and the calculation as to distance were accurate, for when the "Fulton" came up again she was in close range of the mile flags which were to be the marks for her to rise. Then, for the first time, the torpedo was fired from the "Fulton's" bow while she was at full speed and submerged. The torpedo went flying under the water, leaving a white flash of water in its track. This could be plainly seen from the deck of the "Kelpie."

The torpedo was fired at 10.03 and in one second's time the "Fulton" had risen from the water sufficiently to let the captain see the effect of the shot from the conning tower just above the surface of the water. Then the "Fulton" began diving and risking in rapid succession to show how swift she is in coming above surface and dropping again. The shortest time between these dives was three seconds.

The boat was rolling up and down in the water exactly like a huge porpoise, her back showing for a second only and her conning tower never being more than a foot above the surface. This was the most marvelous work the "Fulton" had yet done. Commander Geelnuyden was particularly pleased with it.

At 10.20 o'clock the "Fulton" hauled to and took on board Commander Geelnuyden. The conning tower was closed as they all went into the hold. At 10.40 o'clock she entered her course and immediately dived. It required only eight seconds for her to get under water, and she steered a straight course for a mile, which she made in ten minutes, submerged about ten feet. At 10.50 she came awash and made several porpoise dives, the first being in five seconds, the second in eight seconds, the third in seven seconds and the fourth in four seconds. The result was most satisfactory, and Commander Geelnuyden was pleased.

"I firmly believe," he said, "the submarine boat is going to revolutionize the use of high explosives in naval warfare. I was under water this afternoon for a mile or more and experienced the diving of the 'Fulton.' I must say that I was perfectly comfortable down there, and did not feel any palpitation of the heart when the conning tower was opened and the fresh air let in.'



LAUNCH OF THE FIRST SUBMARINE BOAT AT BARROW, BRITISH COAST.

The first of the five of the submarines of the American type which were prepared for the British was launched at Barrow Yard. The launch was as unusual as the craft itself, for there was no ceremony, and the vessel left the ways unnamed and unnumbered. The boat is so constructed as to offer the least possible

resistance to the water when cruising on the surface, where her motive power is a gasoline engine with a maximum speed of about nine knots an hour. When the vessel is submerged, she is propelled by an electrical motor at a speed of seven knots an hour for a four hours' run.

The current is supplied from storage batteries, and the vessel is lighted by incandescent electric lamps. There is provision for storage of compressed air for ventilation and the steering and driving are regulated by hand. The submarine measures sixty-three feet from stem to stern by eleven feet nine inches beam. After the launch she was towed to the Devonshire Dock to be completed.

Great Britain Wants Them.

Great Britain ordered submarine boats, which in the specification were described as "Holland Submarine Torpedo Boats, Type 7." In their design the builders had the advantage of the experience gained with our American boats, the company having purchased the complete rights for the world except in the United States. The boats are to fulfil certain purposes. They are provided with the means of expelling torpedoes under the following conditions: At rest, or during a run on the surface; before or after submergence; while awash, at rest or full speed, with a sufficient portion of the conning-tower submerged to allow observation to the navigator; and while running submerged. It is further stipulated that all the necessary appliances are to be installed to render the accomplishment of these conditions safe and certain.

The dimensions of the boats are: Length over all, 63 feet 4 inches; beam, 11 feet 9 inches; displacement, submerged, 120 tons. The plating and frames of the hulls are of steel, of sufficient size and thickness to withstand the pressure of depths not over 100 feet. The main engine is of the gasoline type, of 160 horse-power for surface propulsion, and the boat carries a fuel supply sufficient for a run of about 400 knots.

Driven by Storage Battery.

The maximum speed on the surface is nine knots. The main motor is electric and waterproof, giving the vessel a speed of seven knots when submerged. The storage battery has a capacity for a four hours' run at that speed. Gearing is provided to allow of charging the battery or driving the propeller from the main engine, and of driving the propeller or moving engine from the main motor. The electricity generated is also used to light the vessel.

Compressed air, stored on board, with the means of furnishing a supply of air into the interior of the vessel and safety valves, are provided to prevent any excess of pressure in the boat above that of the atmosphere. Means are provided to prevent the vessel from inclining to excessive angles during diving or rising, and to prevent her from diving to excessive depths.

Both steering and diving are managed by handgear, if necessary, although machinery for the purpose is provided. The armament consists of one torpedo expulsion tube, situated in the bows, two feet below the light water line, and each vessel carries five torpedoes.

In diving the boat is brought to an awash condition, with only the conning-

tower ports above water. The dive is made at a small angle until the proper depth is reached, when the boat is brought to a horizontal position. After the discharge of a torpedo the compensation for surface more than three times from the start to the discharge of the torpedo, and then it did not stay on the surface more than a minute.

We may proceed to a review of what

ON THE LEFT IS SHOWN A SUBMARINE BOAT FOULING A FISHING SMACK. A TORPEDO IS FIRED BY A SUBMARINE BOAT SEEN ON THE RIGHT. ITS POSITION IS MARKED BY THE PERISCOPE, THE OPTIC TUBE FOR CONVEYING LIGHT UNDER WATER.

the weight of it is automatic and almost instantaneous. The official trial of the boats consisted of a surface run of ten knots at a speed of seven knots an hour, and of a submerged run of two knots at the same speed. At the end of the submerged run a torpedo was discharged, which was to strike a target 150 feet long to sixteen deep, the upper edge of the target being awash and placed at right angles to the course. During the submerged run the boat did not come to the other foreign Powers are doing in the matter of submarine construction. Taking France, we find that she is leading the way. This is not surprising, since for generations she has been in the van in all matters of naval design. In her old wars she had always the best ships; she was the first to build screw vessels of the line, to coat the side of the warship with mail, to use breech-loading guns, to eliminate wood from her cruisers and battleships, and to employ electricity for the

rotation of turrets and working of guns.

France began the construction of her modern submarine fleet with the Goubet boats, which are not the property of her navy, but were built by the inventor, whose name they bear. No. 1 was constructed in 1888-9, and was of a primitive type, electrically propelled, egg-shaped, 16½ feet long, and generally simple in construction and design. She could be readily moved about from place to place by land, but her speed was low, and she developed on trial an awkward tendency to dive which greatly interefered with her utility. Such as she was, however, she possessed advantages which appealed to the Russian government, and a number of craft of her kind were ordered for the Russian navy, but were never used, even if all were delivered.

The French Boats.

"Goubet No. 2" had great improvements, but was much larger—26¼ feet in length. She has a speed of 6 to 8 knots and carries two torpedoes. Two of her pattern have been built for Brazil. One of these boats remained eight hours at the bottom of Cherbourg harbor, with two men on board. The boat rises or sinks by ejecting or admitting water ballast. Normally she voyages with her low conning tower just out of water; when submerged she uses the periscope, the invention of Lieutenant Mangin, and since perfected by another French officer. This is a brass tube, fitted with prisms and lenses, which is projected above water from the conning tower; it is a feature of all French submarines. From it a view of the surface can be obtained in calm weather. The boat is supplied with compressed air, and the vitiated air is ejected by powerful pumps.

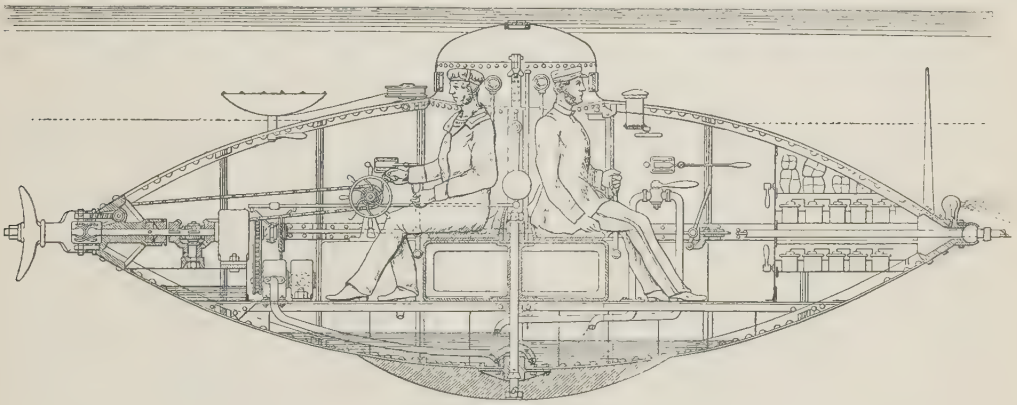
The impetus given to submarine construction by the Goubet boat led the French navy to lay down the "Gymnote" in 1888-9. This is a cigar-shaped craft, 59 feet long by 5 feet 10 inches in diameter amidships. The motive power is electricity, supplied by accumulators; the maximum speed, which was not in practice attained, was to be 10 knots. The craft was meant to be experimental, and so it is not surprising to learn that it was not at first a success. It exhibited many defects when tried at sea, but the experience gained was utilized, improvements were made, and the vessel is in commission as part of the defense of Toulon. The good points were reproduced in the design of Gustave Zede, the largest submarine as yet constructed by any inventor or any Power.

High Rate of Speed.

She is 13¼ feet long, cigar-shaped, displacing 266 tons. Her engines are actuated by electricity stored in accumulators, which have been the cause of innumerable troubles, emitting fumes most deleterious to the men on board, and on one occasion exploding from some unascertained reason. The defect, however, is now said to have been overcome. The "Zede" was laid down in 1892, and launched in 1893; her speed on the surface is 14 knots, and submerged 8 knots. She has a single torpedo tube. In experiments on a smooth and sheltered sheet of water, she torpedoed the "Magenta," without that ship or the "Neptune" and "Marceau" being able to bring a gun to bear upon her, though the imminence of the attack and its hour

were known. In executing this manœuvre she only showed her conning tower five times above the water; even this would not now be necessary with the improved periscope adopted by the French navy.

The universal opinion on board the three battleships which she attacked was that in war she could not have been hit. Her commander reported that she could be trusted to torpedo one or two of a hostile blockading fleet off Toulon. The "Zede" has a high lightly armored conning tower, and can be used running just on the surface. In a voyage from Toulon to Marseilles she displayed excellent nautical qualities. One defect of the "Zede," from the French point of view, was her size and costliness. In addition to this, her practical radius of action was found to be very small.



SECTION OF THE GOUBERT SUBMARINE BOAT.

After prolonged experiments with her, another vessel of her type but of reduced size, the "Morse" was laid down at Cherbourg. The "Morse" displaces 146 tons, is 118 feet long, and has a speed of thirteen knots on the surface. She carries a Dzewiecki torpedo tube. If French accounts can be believed, she is a most successful craft. Her cost has exceeded the original estimate of $125,000 and is about $150,000.

A competition for the best submarine design was held by M. Lockroy in 1896, when Minister of Marine, and the prize was won by M. Laubeuf, with his design for the "submersible" "Narval," a craft differing from other French submarines in her shape, which is much that of the normal torpedo boat. She is ordinarily intended to run upon the surface, only sinking when the enemy is approached. The "Narval" was laid down in 1898, launched in October, 1899, and has been under trial repeatedly.

The "Narval" is designed for work in three positions. On the surface, in about the trim of the ordinary torpedo boat, she uses an oil motor and can steam twelve knots. Her radius of action at this speed is 252 miles, or, steaming eight knots, 624 miles. Awash, with only her funnel and conning tower projecting, she has the same speed and the same radius. With her funnel shut down and fully submerged she uses an electric motor, and can run at a speed of eight

knots for twenty-five miles, or at five knots for seventy miles. She has four Dzewiecki torpedo tubes. She is designed to remain at rest below the surface, so that if she encounters a hostile warship she can promptly descend and remain quite invisible till her enemy has moved off. She displaces 100 tons and is 111 feet long.

The German navy has been experimenting with a submarine boat. The Russian navy, having burnt its fingers over the Goubet boat, has done nothing lately in this direction. The Italian navy has the "Defino," which proved a success. Still, no more have been laid down. Spain has the old "Pearl," tried long ago, and pronounced a paragon of excellence, but never repeated or employed. Cervera, in his long correspondence, never alludes to her, and it may be concluded that she is really a failure. Greece has two Nordenfelt submarine boats, and Turkey also two, but neither Power used them in the war of 1897. Brazil has two improved Goubet boats. The United States have decided to purchase boats of the Holland pattern.

Holland No. 2.

The "Holland No. 2," which was tried before a committee of American naval officers and a number of foreign experts, is similar in many respects to the "Narval," though its shape is cigarlike, with a superstructure and funnel. On the surface it runs at fourteen knots and burns oil; when submerged it trusts to electricity, and can make eight knots. It was designed in 1892, and was incomplete in 1898 when the war with Spain broke out.

In estimating the value of the submarine we have to remember that as yet it is not sea-keeping, and that its radius is relatively small. But even so the new French boats are quite capable of making the Channel very uncomfortable for foreign ships, and they will effectively prevent blockades of the Santiago type, where big ships closely approached a hostile port and lay, with fires out, motionless or drifting with the tide. Their moral effect must be tremendous, and if they do half what the French claim for them, the risk from them would be very great.

To Build New Vessels.

There is one fact which may legitimately lead us to argue that the submarine is more formidable than we have supposed. This is that the French Admiralty, after a prolonged pause in submarine construction, decided to build twenty-six more vessels of the "Norval" type under the new programme. Such a decision is clear evidence that the submarine is not a failure. The French Admiralty is not prone to hasty conclusions; if not so conservative as some other organizations, it is yet conservative enough. It has always disliked the submarine and fought against it, so that the victory of the strange craft plainly evinces the interest felt in this mode of warfare by the naval bureaus of the world.

There can be no doubt that submarine boats are destined to soon come into general use. The problem of navigation under the surface of the water has been successfully solved, and the navies of the world will easily find a way to use them in the warfare of the future.

HEROIC ACHIEVEMENTS

Thrilling Deeds Performed by Life-Saving Crews, Who Risk Their Own Lives to Save Others—Story of a Captain Who Rescued Over One Hundred Persons.

AMONG the bravest men, whose valiant deeds stand on the pages of history, those who man the life-saving stations along our coasts hold a prominent place. We only hear of their achievements when the thrilling tale is told of some vessel that has been wrecked, while all on board have been rescued from a watery grave. It has been said repeatedly that the life-saving service has never received the recognition from the public which it deserves, nor any adequate support by our government. It is difficult to account for this, because the value of the service rendered must be apparent to everybody.

The men who push out in their lifeboats to a shattered wreck are never sure that they will return. Not only is there an insufficient number of these scattered along our coasts, but since they do their work in comparative obscurity, there are few to sound their praises. And yet every year hundreds of lives are saved by these men, who take no account of storm or danger when human life is in peril.

Persons who happen to be present at a life-saving station when the boat with its gallant rescuers pushes off on its mission of mercy, can appreciate the wonderful services rendered by these men.

If you were on a shattered ship, ready to sink at any moment, you would hail the sight of a lifeboat coming to your help, and would be apt to bestow proper appreciation upon those who had undertaken your deliverance.

Life-saving stations are furnished with all the means of rescue. Sometimes it is impossible for the lifeboat to reach the ship, but a line may be shot over the vessel from the shore, and an apparatus sent out by which the passenger or the sailor may be safely landed. As an illustration of this mode of rescue take the following from one of our prominent journals.

"A Norwegian vessel named the 'Esras,' of 266 tons register, bound from Christiansand to Pamviauf, ran ashore on the Hasboro' sands about 8 o'clock in the evening. There she lay the whole night through, at the mercy of the howling winds and huge seas, and during the hours of darkness her mast went by the board. Next morning she dropped anchor and found herself stranded on the Norfolk coast about opposite East Runton. Her position was one of peril to the crew, and just before 6 o'clock the Cromer and Sheringham Rocket Brigades were summoned.

"The vessel lay at the mercy of huge

breakers, and after about two hours broke from her moorings and came broadside on the Runton beach some 500 yards from land. The rocket apparatus was got to work, but at first it failed. At the fifth attempt the Cromer rocket succeeded in reaching the 'Esras' and all the crew were saved. The work of the Rocket Brigade is deserving of the highest commendation. The sight was watched with keen interest by hundreds of people."

LIFE-SAVING APPARATUS AT WORK.

From a Boston journal we take the following account of a disaster that occurred on our Atlantic coast:

"The loss of twelve lives off the treacherous shoals of Monomoy is said to be the worst disaster of its class that has occurred since the life-saving station was established. And what a magnificent service it has been and is; how rich in human achievement, how glorious in its record of daring and sacrifice, how modest in its pretentions and its claims! Its field of operations is the angry and tumultuous sea. It is attended by no martial pomp; it is stimulated by no artificial excitements. Those who enlist in it have to rely upon their own stoutness of heart and steadfastness of purpose.

"They endure almost constant hardships; their life is an almost continual struggle with the elements and their battles are always to save and never to destroy their fellowmen. When they

succeed, as so often they do, the names of these heroes are rarely mentioned. The papers tell us that the life-saving station at such a point went to the relief of the distressed crew.

"Yet epics have been built upon less than is covered by such a bald and bare statement. The casual reader looks upon it all as a matter of course. The rescuers have done what they were engaged to do. A skirmish in the bush, a successful fight with savages will set his blood tingling; but he looks with indifference upon a battle with angry waves through icy waters. His imagination is not kindled by these homely exploits, and he goes home to dinner without another thought of the terrible struggles and splendid achievements of these devoted men who seem to find their reward in doing and not in glory or in gain.

"It is only when we contemplate totals that we get a truly realizing sense of what this service means to our country, to our humanity, and to the interests of those who go down to the sea in ships or trust their ventures to its fickle mercies. It is a little over thirty years since this service was established. In that time it has saved in various portions of the country about ninety thousand lives, and property enough to pay several times over the cost of maintenance.

LIFE-BOAT HURRYING TO THE RESCUE.

"These 90,000 witnesses have known something of the true worth of these men, and their gratitude to them has doubtless been greater than that which they feel toward any other class in the world. They have known the dangers involved, the bravery and the skill that carried them through their perilous duty. The saviors are constantly facing dangers which the saved perhaps experience only once in a lifetime.

'And some of the best and most genuine types of this noble class were the men who went down at Monomoy. They knew what they had to encounter better than anyone else; but they did not flinch for an instant. Whether life or death awaited them they would make the attempt, and the men who still survive would face an equal peril to-day with as little hesitation should the occasion arise."

Another journal furnishes an additional account of the same catastrophe. The article is appropriately headed: "The Heroes of Monomoy."

Seven Heroes.

"Monomoy Point, where the sea tragedy occurred, when seven men lost their lives in the vain effort to save five, is the most southerly point of the mainland of Massachusetts. Just where Cape Cod bends its elbow in the Atlantic Ocean surges a splinter of sand juts downward, and on the lower point is Monomoy Life Saving Station, all but two of the crew of which were drowned trying to save the crews of two barges stranded on Shovelful Shoal, three-quarters of a mile from the point.

"On Monday the weather grew thick. An easterly gale rose, and the men aboard the stranded barges hoisted a signal for help. It was a fearful sea, but the men of Monomoy knew only the word of duty while those signals of distress were flying. The boat was pushed off into the hungry sea manned by eight of the nine men at the station, and after mastering almost insurmountable difficulties the errand of mercy was nearly accomplished, when a cross sea caught the boat and of the thirteen men in it only one was left to tell the story. 'Dinner was all ready for them,' said the one left at the station. 'The table was set and the coffee and soup were hot on the stove. It was my cook week, and while the rest of them took the boat out to the barge I had to stay behind and get the meals ready. Perhaps that's why I'm here now.' And he continued: 'There wasn't a braver, a better set of men anywhere on the coast than these comrades of mine who have gone. They were friends all—never a hard word, never anything out of the way except in jest; as happy a family as you ever saw. The worst night that any one of them had to go out in never made any difference in their spirits.'

"Boston raised a fund to care for the families of these heroes of Monomoy. It soon reached $14,000. But while this is the only material comfort that can now be given the bereaved, some other tribute is due the men who pushed out their boat into the angry sea and went on an errand which to all but one of them meant death. Their names deserve to be inscribed among the bravest of heroes who have lost their lives in the service of humanity."

Story of a Brave Captain.

This is the story of Captain Joshua James. It is a simple story, yet it is one well worth reading, for it is a narrative of a man known as the world's greatest life saver. During his career of seventy-seven years it is estimated that over one hundred persons were rescued by him from death by drowning.

"I shall die with my boots on," he often said, and so he did die. One morn-

ing Captain James was sending his crew through the drill at Point Allerton.

"Now, the next thing boys," he said, and fell unconscious. Doctors were hastily sent for, but he had passed away. Heart disease, the doctors said, was the cause of death. But these two words by no means express the years of watching on the coast by night, the lonely vigils, the plunges through the stormy sea, and the daring rescues which required the expenditure of life's forces.

Muscles Like Steel.

Captain James was a well-known character in Hull, and a man of picturesque appearance. He was over six feet tall, and he was thin, but his muscles were like steel. The power and determination expressed in his face were not concealed in the six inches of whiskers which seemed to be his only vanity.

He was known to all seafaring men along the Atlantic coast, and respected and honored by them. For nearly thirty years he had been connected with the life saving service. At first he had a volunteer crew, but when the Government took charge of this work he was made captain by a special act of Congress, as he was many years older than the prescribed age.

Captain James was born in Hull. His father, Captain William James, a native of Holland, came to this country about 1805. Esther Dill, his mother, a lineal descendant of the earliest settlers of Plymouth County, was noted for her philanthropy and bravery. She was a veritable mother to the many men employed on her husband's vessels. When only 44 years old she was accidentally drowned in the whirlpools of Hull Gut. One of the noblest acts of bravery ever performed in the life saving service took place at Nantasket Beach, when Captain James and his crew rescued the men of the three-masted schooner "Ulrica" and nearly lost their own lives in the attempt.

The storm, which had been raging furiously, increased so rapidly as to make an attempt to reach port impossible, and Captain Patterson, of the "Ulrica," decided to stand out in the open sea. About 6 o'clock in the morning the "Ulrica" was off the lightship, and, soon after this friendly beacon was sighted, there was a succession of sharp reports as the sails were rent from their fastenings and blown away like shreds of paper.

Pounded By Immense Breakers.

The seas were breaking over the vessel, and the half frozen crew made preparations to get out the anchors. They were successful in this, but the anchors did not hold, and the helpless craft was blown across the bay and onto the sands of Nantasket, with her crew powerless to save her.

The "Ulrica" struck broadsides on, about 1500 feet off shore, just opposite the Kenberma Station, at that part of the beach called Strawberry Hill. Immense breakers pounded against her sides like a battering arm, and in a few minutes, with a report like a cannon, the back of the ship was broken in two. The "Ulrica" was seen by a boy named Henry Baker, who sent word to the life-saving station at Stony Beach, three miles away.

Captain James and his crew started for the scene of the wreck on a special train, leaving two men to follow with the life

saving gun. When they reached Kenberma, hundreds of persons had collected on the beach, but they were powerless to aid the imperiled sailors. It looked like instant death to face the raging storm. They could see the crew of the "Ulrica" in the darkness huddling together on the forward part of the vessel. The waves were dashing over them, and now and again some one lost his footing and was swept across the deck, but the men whose business it was to save life were undaunted.

Hurled Back on the Beach.

They launched their boat in the face of the fierce gale and before they could grasp an oar an enormous breaker hurled them back upon the beach. A second time were they driven back; but the third attempt was more successful.

Slowly they proceeded toward the "Ulrica." Waves dashed over them every second, almost exhausting their strength. Cheered by the words and spirit of their undaunted captain they had proceeded about one hundred and fifty yards, when a gigantic comber struck the boat and threw it high in the air. Captain James lost his balance and fell into the roaring waters. The other members of the crew managed to retain their seats, but in the next minute they were washed ashore 500 feet from where they started.

The instant the lifeboat struck the sand every man plunged back into the sea to rescue their captain, who was making an awful battle for life in the roaring waters, which seemed to engulf him at every instant. The scene was memorable. Many of the spectators on the beach were so enthused at the sight that they, too braved the surf to assist the life savers. Captain James was brought safely to shore, but weak and exhausted as he was, directed the firing of the Hunt gun which at that moment had arrived.

The first shot carried the life line among the rigging near the masthead, so that the men aboard the "Ulrica" were unable to get near it. A second shot was fired, and again the line fell beyond the reach of the exhausted and half-frozen sailors. On the third shot the hopeful life line dangled again in the upper rigging. A few minutes later however, it fell across the deck, where it was secured by one of the men.

Unable to mount into the rigging, the poor fellows were obliged to fasten a hawser on the deck near the anchor chains. This allowed the line to the shore to slacken so that it was impossible to work the breeches buoy, and it seemed as if the crew must perish.

The Last Hope.

When all hope seemed abandoned Captain James thought of a last plan. The big hawser still held secure from shore to ship, and he thought that the lifeboat might be pulled out to the doomed vessel by means of this rope. Another rope was attached to the stern of the lifeboat, and then the brave fellows jumped in to make a last effort to save the crew of the "Ulrica."

Awaiting a favorable opportunity, the lifeboat was pushed off, and then every man in her grasped the big cable and pulled with might and main. The waves broke over the little band, and the water freezing, covered them with ice. But they held on pluckily. Slowly and surely

the boat climbed the mountain waves and descended into green yawning chasms, until the side of the stranded vessel was reached.

The men aboard the wreck were found to be in a state of almost complete exhaustion, and it was with the greatest difficulty that they were able to throw themselves into the lifeboat.

When the last man was safe in the lifeboat, Captain James signalled the crowd on shore, and every person on the beach seized the rope, which had been fastened to the stern of the boat, and pulled the imperiled men back to safety. On the shoreward voyage it was necessary for the life savers to cling to the hawser to save themselves from being swamped, and by the time the beach was reached Captain James and his brave crew were found to be almost as exhausted as the sailors they went to rescue. Such are the dangers and hardships of the sailor's life.

TIMBER FLUMES OF CANADA

Waterways for Transporting Logs and Lumber to the Saw-Mills—Swift Descent of the Lumbermen.

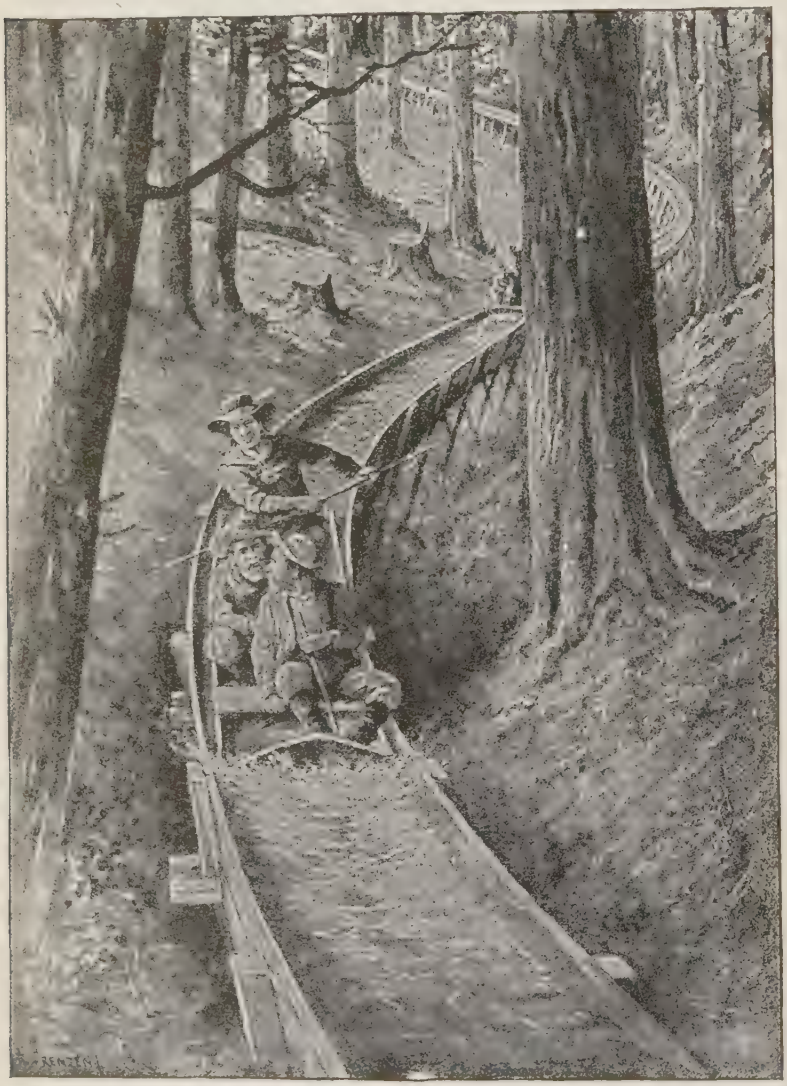
IN rough forest districts, sometimes mountainous and difficult of access, the lumbermen are compelled to devise some quick and easy method for transporting logs to the mills. The saw-mills are invariably in the valleys, while the forests from which the logs are obtained may be miles away.

In nearly all the lumber regions the workmen can depend on snow freshets and rains which form mountain torrents. These are made to do the work that otherwise it would be almost impossible to accomplish.

The flumes, which are used to float logs and hewn timber from the mountain tops to the saw-mills, are fed by the torrents, and are, in some cases, three or four miles long. The lumbermen, after a week's work in camp, save a tedious journey by constructing a rough wooden skiff and using the waterway, traveling at times at the rate of a mile a minute. Where the descent is very steep the water rushes through the flume at a furious rate, carrying with it the rude skiff and the men who take this method of making a quick journey to the valley below.

A gaff is used as a break, and a good deal of skill and strength are often required to make the perilous descent and escape a sudden ducking. The lumbermen become experts in guiding their craft, and prefer to take the chances of accident rather than make the descent on foot.

The forest products of Canada constitute one of her most important sources of wealth They find their way to all parts of the world—to the United States, to the United Kingdom, and to the Australian colonies. The Canadian sawmills are extensive and well appointed. The industry in all its stages employs large numbers of men, as well as affording freight to railways and shipping. Among the varieties of trees are the maple (hard and soft), elm, hickory, ironwood, pine, spruce, cedar, hemlock, walnut, oak, butternut, basswood, poplar, chestnut, rowan, willow, black and white birch, and many more.



A TIMBER FLUME IN BRITISH COLUMBIA.

The forests of Canada abound in fine timber, adapted to almost every variety of useful or ornamental work, and furnishing one main element of wealth to the provinces. Foremost in point of utility are the white and red pine, annually exported in large quantities to the United States and to Europe. Three-fourths of the square and flatted timber produced in the Ottawa region is white pine. Cedar, red pine and railway ties, chiefly made of tamarac, are produced in large quantities. Pine trees of 100 feet high are not uncommon; and the instances are not rare of trees greatly exceeding that height. The pine prepared for exportation is made into squared timber, measuring from 60 to 70 feet in length, and the Canadian product finds a ready sale.

THE AUTOMOBILE.

Advent of Horseless Carriages—How the Vehicles are Made to Go—New Mode of Traveling.

THE idea of the automobile is not new. Attempts were made centuries ago to imitate the sail boat on land and wagons were constructed with masts and sails. These, however, were never successful, chiefly from the fact they must travel a prescribed route often sheltered from the wind by objects that line the roadway. The idea of applying other power to the road wagon is also old. The first attempt to construct such a wagon is ascribed to the Frenchman Cugnot, who more than a century and a quarter ago built a crude steam wagon. This was the forerunner of our automobile of the present time. During the next fifty years no important attempts at construction are chronicled, but in the early part of the nineteenth century, with the railroads in successful operation, a number of inventors built steam carriages. Messrs. Dietz and Herman had a steam carriage, equipped to carry twenty passengers, on the road between Vincennes and Paris, and in England there were Hancock, Macor, Church, Gibbs, Fraser, and others building and operating steam carriages. Of these Hancock was probably the most successful.

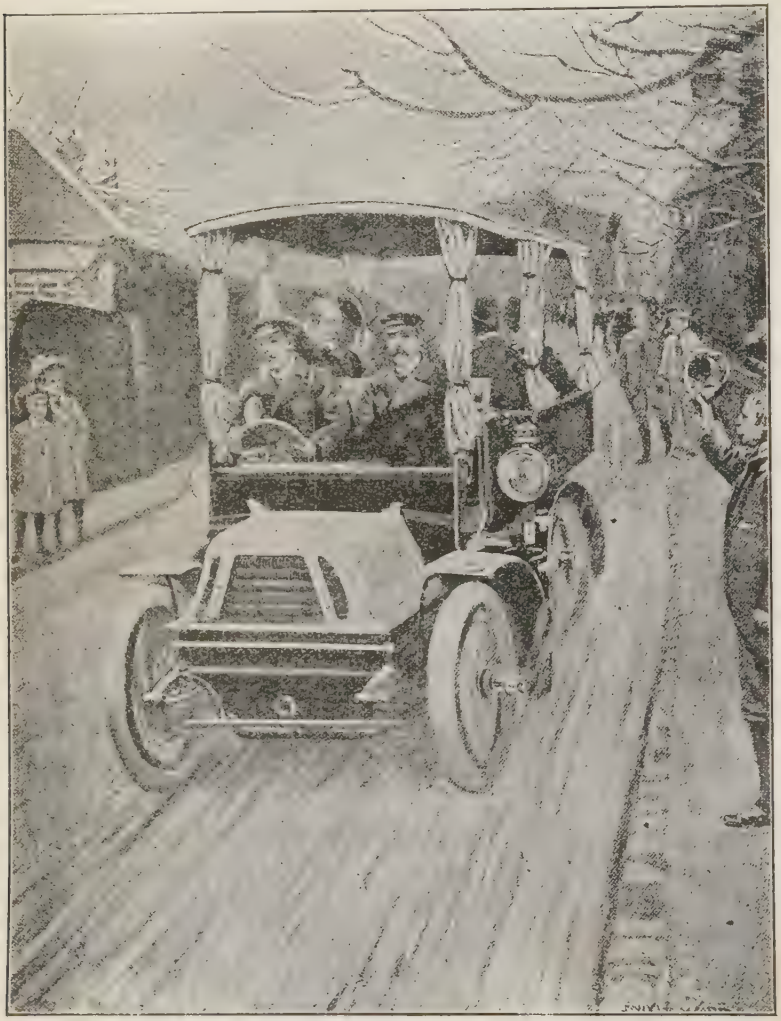
Mr. W. Hancock commenced his experiments in 1825 or '6. His first carriage was the Infant, completed in 1831, afterwards almost entirely rebuilt. The Era was next built for a stock company, but for some reason made but two or three runs. In 1832 he built the Enterprise for a Paddington company. This ran for sixteen consecutive days on the Paddington road, and then was housed.

Bulky Vehicle.

He then built the Autopsy. This cost about $3,500, seven hundred pounds, burned ten or twelve pounds of coke per mile weighed about three tons, accommodated fourteen passengers, traveled ten to twelve miles an hour, and carried fuel and water for an eight mile run. This carriage ran for several months between Paddington and London, making two trips each way daily and carrying several thousand passengers at sixpence a trip.

The carriage of Church built at about this time was designed to carry fifty passengers and was large in proportion. Mr. Gurney completed a carrage in 1827 which ran some time between Cheltenham and Gloucester. Nearly all of these carriages failed to withstand severe strains put upon them over the imperfect roads traveled. Leaky boilers, broken wheels and frames soon brought the

wagon to the repair shop, then the necessary funds for the repairs were not forthcoming and it was soon found on the scrap pile.



THE KING'S NEW METHOD OF TRAVELING.

King Edward enjoys a privilege which none of his royal predecessors has had. He is the first sovereign of England to have the motor-car service. His journeys through the quiet lanes of the country in his new conveyance excite the greatest interest and surprise among the villagers.

These carriages were built to compete with the stage coaches on short routes. The railroads were also supplanting the stage lines and the two were brought into the field where the railroad had the advantage. Capital was more easily secured by the railroads, and it is perhaps justly claimed that it was railroad influence that secured the legislation which in England deprived the steam carriage of its freedom on the highway.

In America we find no record of any such attempts to build self propelled carriages at this period. But along in the fifties Mr. Richard Dudgeon of New York City built one or two steam wagons which would carry ten or twelve passengers. In this the boiler, covered with a heavy mat, formed the floor of the car and the seats were on frames at the side facing toward the centre. This car burned coal and weighed over two tons.

In America the present automobile received marked attention, and in many respects the practice of the foreign builder has been followed. In the race organized for November 2, 1895, by the Chicago "Times-Herald," the gasolene automobile of H. Mueller & Co., of Decatur,

Ill., won the prize of five hundred dollars. This wagon was imported from Manheim, Germany. In the race of November 28, 1895, for which the above paper offered prizes amounting to five thousand dollars, a great variety of automobiles were entered. This contest was open to the world, and for the fifty-four mile run a large number of foreign carriages were entered.

All who witnessed that race will not soon forget the day with its rain and snow, slush and ice. It would have been an impossibility for a horse-drawn vehicle to have covered the distance, so that it was not remarkable that so few vehicles appeared at the start. A number broke down on their way to the starting point. Among these was the carriage entered by the Haynes-Apperson Company, who were one of the first in this country to undertake the construction of automobiles. In crossing a street car track they were obliged to turn quickly to avoid a collision with a street car, and a wheel was broken. The three wagons that distanced all others in that race were of foreign make, with possibly a few American improvements.

America Far Ahead.

In 1896 the Cosmopolitan race brought out again the automobiles in competition, and since then the industry can be said to have been fully launched in this country. In one particular, possibly two, the American inventors can justly claim originality and an advancement far above all others. In the design and construction of steam automobiles America is far ahead, and new designs are promised in the near future. The electric vehicle, especially the cab, has found a permanent place in America.

THE AUTOMOBILE.

It doesn't shy at papers
As they blow along the street;
It cuts no silly capers
On the dashboard with its feet;
It doesn't paw the sod up all around the hitching post,
It doesn't scare at shadows as a man would at a ghost;
It doesn't gnaw the manger,
It doesn't waste the hay,
Nor put you into danger
When the brass bands play.

It makes no wild endeavor
To switch away the flies;
It sheds no hair that ever
Gets in your mouth and eyes;
It speeds along the highway and never looks around
For things that it may scare at and spill you on the ground!
It doesn't mind the circus,
It's not at all afraid;
And it doesn't overwork us
When the elephants parade.

It doesn't rear and quiver
When the train goes rushing by;
It doesn't stand and shiver
When the little snowflakes fly;
It doesn't mind the thunder nor the lightning's blinding flash;
It doesn't keep you chirping and connecting with the lash;
It never minds the banners
They display on holidays;
It's a thing of proper manners,
Which it shows in many ways.

When you chance to pass the stable
You do not have to care,
Or cluck for all you're able
To keep from stopping there!
It will work all through the daytime and still be fresh at night;
There is no one to arrest you if you do not treat it right!

It's wheezings ne'er distress you
As it moves along the way—
Farewell old Dobbin, bless you!
You were all right in your day.

The Columbia Electric Omnibus.

In America, where electric motors are the favorites with builders, one naturally expects an electric omnibus, and this has been built. The Columbia electric omnibus has an attractive appearance, lacking entirely the clumsiness which is evidently a defect in many of the designs so far produced. Both outside and inside seats are provided, affording accommodations for fourteen passengers, besides a quantity of baggage on the roof, around which a rail is built.

The wheels are wood with heavy cushion tires. It has one motor geared to rear axle. A maximum speed of ten miles per hour, loaded for a thirty-five mile run, has been attained from one charge of the batteries on ordinary country roads. The controller gives a range of three speeds forward and three to the rear. It is well equipped with brakes that are easily applied. The interior of the 'bus is nicely upholstered in brown morocco.

The windows are provided with silk shades, and the work is finished in cherry, ash and whitewood. The interior is, of course, equipped with electric lamps and the other expected conveniences of modern urban travel. The wheel base is 8 feet and the wheel gauge 5½ feet. The wheels are 36-inch for the front and 42-inch for the rear, and equipped with 3½-inch solid Kelly tires.

The steering is accomplished by means of a horizontal handle standing normally parallel to and slightly in front of the driver's seat, and hinged to the steering post which passes up just inside of the body at the driver's left. The motor is suspended in front of the rear axle, and is contained in the usual torpedo tube casing, which also enclosed the differential gear. The motor is of four horsepower normal capacity, but capable of developing three times this output.

Horseless vehicles are no longer curiosities in any large city, and their general use is more common than most people realize. In Paris and other large European cities, automobiles are now almost as numerous as bicycles. In the larger cities of America they are seen in great numbers, and their uses are rapidly extending.

New York's Fire Automobile.

A vehicle was built for the use of Chief Croker, chief of the New York fire department. It was placed in service, and the opportunity to test it was not long in coming to hand. An alarm from Station 241, Houston street and the Bowery, was received one night, and the firemen hustled the horses under the collars in record time as the doors flew open. Chief Croker was upstairs in his office.

Station 241 is one of the boxes at which he is due, and his driver jumped for the wagon. In another second the chief was in it also, and had his hand on the lever. The engine and tender of the company had left the house, and as the mile-a-minute wagon turned out of the house the company was two hundred yards ahead. Around into the Bowery dashed the company at breakneck speed, and the automobile was still one hundred yards in the rear.

When Chief Croker had reached the wide Bowery, he gave his record breaker a free rein. The machine bounded forward, and with every yard its speed increased. In a hundred yards it was traveling like an express train. The flying tender was soon left behind, and then the engine was overhauled as it passed Bleecker street, and Chief Croker was the first to reach the fire.

Ever since the development of the power of Niagara Falls commenced the use of electric power on the Erie Canal has been agitated. Various schemes have been proposed which the technical press has illustrated, but up to the present time, aside from a few crude tests made with power from street railway lines, nothing has been accomplished. European engineers have done more, and have in operation several systems in Germany. One of these is an electric system using a trolley car.

For a delivery wagon, the numerous automobiles to be seen on our streets in regular use by the city stores attest their success for this purpose. That it will be equally serviceable in the collection, transportation and distribution of mail matter must be conceded. The good name of the automobile has helped to secure a reduction in the contract price for the transportation of mail in many instances, and a considerable reduction in the expense of this part of the post office department has been effected. The bicycle has been used to advantage in

MODERN MODE OF TRAVELING BY BICYCLE AND MOTOR CAR.

collecting mail for a number of years. The motor carriage with its greater carrying capacity and the greater facility with which it will be handled will supplant the former and add much to the service.

The Combination Vehicle.

An electric vehicle driven by a motor which receives its current from a dynamo propelled by a gas engine, seems at first sight an absurd proposition. "Too many transformations." "Too much complication." "Why don't you use the power of the gas engine direct?" is heard on every side. Here is a most fertile field for the sober second thought.

To the electric devotee may be said: Take out your storage battery and replace it with a gas engine and dynamo of equivalent power. It weighs less, requires no charging, and is therefore of practically unlimited radius. If you are a sincere electrician there is none of the devices of your art that you would prefer to keep out of a fool proof test than your storage battery. It is a good, reliable friend if you take good care of it, but take care of it you must.

Your silent storage battery has been replaced by a device giving a little odor, a little noise and a little vibration, in return for which you have eliminated overcharge and discharge, sulphating, buckling, corrosion, slipping and spilling. A great electrician once said of a storage battery: "It's wet," and he meant much.

American travelers in Europe brought home very definite ideas on automobile fashions, and to a considerable extent succeeded in gratifying these ideas on the home industry. The outcome was a "boom" for the Tonneau style of touring automobile, which has set its mark not only on gasolene vehicles (for which the design was originated), but has been imitated for electric and steam carriages.

Wide awake manufacturers in touch with transatlantic movements discovered this trend of fashion early and adapted their product to its dictum. Others followed more reluctantly, and others again are resisting it to this day, and not without success in their own direction.

These factors produced great activity in manufacturing circles in adapting American forms of motors to new carriage styles, on one side, and in perfecting these specifically American styles to meet the new competition, on the other. That the automobile movement as a whole has been highly stimulated by the blending of domestic and foreign ideas, is attested by the many additions to existing plants which are being built in order to increase productive facilities.

American Superiority.

The loan exhibition, consisting of imported French, English and German machines, added to the general interest, and enabled the public to make close comparisons between automobiles imported at a cost of from $5,000 to $15,000 and the products of American manufacturers marketed at from $500 to $3,000, affording entire satisfaction.

From this comparison American builders confidently expect to emerge with flying colors, in as much more as they may point out to visitors that the very latest French developments are greatly influenced by the progress in American motor construction, as much so, indeed, as American design has been

modified through the adaptation of pleasing features in French inventions.

These remarks apply mainly to gasolene automobiles. In this branch of automobilism enormous strides have been taken toward meeting the public's requirements of an efficient, practical vehicle. The size, comfort, elegance and general serviceability of the gasolene carriages represent an advancement which it is barely possible to conceive.

Steam Pleasure Vehicles.

The production of steam pleasure vehicles constitutes a strictly American department of the automobile industry. The number of steam carriages in actual circulation in New York and the United States generally probably exceeds that of electric and gasolene vehicles combined. There is little evidence of this fact, for the reason that steam vehicles have not been manufactured in so many varying styles as the other types. A strong effort to remedy this sameness is manifested. At first the small steam runabout was practically the only form with which the public was familiar, but now may be seen large-sized steam touring carriages, surreys, wagonettes and merchandise delivery wagons in plenty.

The steam principle for automobiles has received its final seal of approval as a dependable method of locomotion. Many steam vehicles have an astonishing capacity for passing through the worst possible vicissitudes of road surface and weather conditions without breakage or the need of repairs.

People who love healthy excitement have not yet discovered that for excitement of rapid motion there is no sport like motor-riding. Some men who enjoy a gallop after hounds have found out that they can get the same delight in summer. Indeed, a grander delight, so far as it consists in the sense of rush and race, for what "run" can equal in that respect what has just been done in the Paris-Toulouse race, a continuous course of near 1000 miles, at an average rate of about thirty-three miles an hour, and that right over the central plateau of France?

The carriage that flies is not a snorting, snuffling, hesitating little gig, nor the well meant but ponderous vehicles sometimes designated by the street boy with unconscious irony as "motor carts." The carriages that fly are massive, but not heavy looking; they would seem complicated, perhaps, to the ordinary man, but when once you know a bit about them they strike you as of workmanlike simplicity. All complicated mechanism is avoided as far as possible.

Parts of the Machinery.

A full third of the length is occupied by the case covering the engines. Upon the dashboard is an array of small circular plated grease boxes, which upon being turned force the necessary lubricant down to the various wearing surfaces; the cylinders themselves are oiled by a mechanical arrangement which regulates the quantity according to the speed. Then there are taps for adjusting the mixture of air and spirit vapor, which being exploded behind the piston is the motive force. The seats must be thoroughly well stuffed for comfort upon long journeys. The number of such carriages at present made is small, but in a few years they will be comparatively common.

An enthusiastic automobilist thus writes:

"Suppose you are going to have the same bit of fun as I have been enjoying. The car is ready at the door. You hear the sound she is making—not a continuous pulsation like a steam engine, or a rapid succession of puffs like the smaller motors, but a burst of explosions—four, but too quick for the ear to separate—like a bronchial giant clearing his throat; then a pause of silence, lasting as much as three or occasionally even five seconds; then another cough, another interval, and so on. The periods are the result of a device which regulates the intake of charge until the revolutions of the fly-wheel have slowed down to a predetermined point, and then allows a fresh cylinder-full to be drawn in.

THE HARE AND THE TORTOISE RETOLD—THE HARE LEADS.

"But think what an enormous reserve of power this means. Imagine these explosions, which unless they were muffled would bark with the report of a machine gun, permitted to follow one another so closely as to be continuous; well, that means that the engine will be giving off the whole day long, up hill and down dale, without wearying, without turning a hair, a force of 20 to 30 horse-power; and everybody knows that the horse is not yet bred which can do its theoretical work of one horse-power for any length of time at a stretch without breaking down.

"Take your seat. You've got your specs on—not a mere ordinary pair of glasses on wires, but deep goggles on gauze sides, and a flap of silk to shut out the draught. They don't look well I grant you, but you must have them when you are running at 40 miles an hour. You've got some warm wraps on too;

that's right; you may be sure you won't be too hot; only tuck them in well; you mustn't have anything flapping about or wanting to be looked after; you'll have enough to do to take care of yourself.

How to Drive.

"Specially have everything snug if you're going to sit beside the driver. Watch him. He throws forward a lever to bring together the proper pair of cog-wheels for the lowest speed. Then he lets the pedal rise gradually. That couples the engine with the carriage wheels; you feel her start. But it need not have been a bit jerky if he had lifted his toe more carefully. Yes, that noise was putting in a higher speed. It's a matter of skill very much to do it quietly, but there is generally a little jar. This is the least perfect part of the whole concern, carrying the power from where it is generated to where it does its work—not far off half of it is wasted on the way. Of course belts shift sweeter than cogs, but they sometimes slip.

"You seem to be traveling quite slowly, but it is deceptive; you're going quicker than you think. Glance back at the ground running away and the dust spurned from the tires; it is a swift pace.

"No, the rise makes very little difference to a car like this. You hardly noticed it, though it's getting pretty steep. That was the worst of the earlier motors, they crawled up hill so tiresomely; then if one wanted to keep up a decent average the only thing was to tear down hill dangerously. With the big cars of to-day the wise man will often take more time running down than he did to go up. There is certainly not the same temptation to reckless driving with ample power as with only just sufficient, therefore the authorities at home ought to smile upon big cars. You'll do this hill all right without lowering gear; those great chains are tugging on the spokes with almost irresistible force. That's it. Keep her well in hand, and have your foot-brake in reserve.

"Now for a piece of level, and you'll see what flying is like. Jam down your hat. None of the packages adrift? All right, sit down tight, and you'd better get a grip of the side. I've fixed my stop-watch handy. Listen to the exhaust; you hear the motor quickening; she is making the best of the third speed; now she is cutting out, she wants more to do. Click in the fourth. He did that well, you scarcely felt it.

Rapid Revolutions.

"The explosions, though you don't hear much of them, seem to be treading on one another's heels now and making one continuous stream of sound, but each volley represents a turn of the fly-wheel. But never mind that, just listen to the music of the gear. Whirling around in their bath of oil, a thousand times or more a minute, these toothed discs do indeed make music to the ear of the enthusiast. Notice how it rises in pitch higher and higher as the car gathers impetus. Now, but not a moment sooner or you would shake your engine to pieces, down goes the accelerator, taking the bit as it were out of its mouth. She is moving at last.

"You feel yourself pressed by the rush of air against the back of your seat. Put your head down. How it whizzes past

your face—a sovereign cure for neuralgia though you might not think it. And the grass at the roadside, and the poplar trees. It's a fine long stretch, straight and all clear. The mile stones skim away behind. That is over forty-two miles an hour. It is fast riding, and as exhilarating as anyone could wish.

"'What did I say? Oh, I asked what you thought of it.'

"'As good as flying.'

"'Makes your blood stir, doesn't it? But I can't make you hear, sitting behind. The rush of air carries words away. And we shall have another half hour of it with luck before we come to the next village.'"

EMINENT AMERICAN WOMEN AND THE GREAT INFLUENCE THEY EXERT

MISS MARGARET LIVINGSTON CHANLER, independently wealthy, member of the Astor family, and a Red Cross nurse during the Spanish-American war, figures prominently in Greater New York as the woman in politics and charity. As vice-president of the Women's Municipal League she occupies an office in the Syndicate Building overlooking City Hall, and this most active young woman keeps in close touch with municipal affairs.

The league takes a sisterly interest in the proper government of the city because of the prominent part it took during the last campaign and the great influence it exerted on behalf of good government. Not only did the members make a house-to-house canvass and buttonhole voters to cast their ballots for fusion, but they carried out their sympathy on a still more practical line and about two weeks before election day a committee of the women went before the leaders at the Republican and Citizen's Union headquarters with a certified check for $20,000 and turned it over to the Campaign Committee with the remark: "Here, gentlemen, is a contribution from the women of New York city who desire to see a cleaner city administration."

Then, too, they distributed tracts, held meetings and in other ways assisted in overthrowing bad government.

So that the Women's League has an acknowledged right to keep tabs on his Honor the Mayor, and to see that his subordinates are performing their duties properly. Indeed, they even went so far

as to ask for an office in the City Hall building itself, but when it was explained that all the available room was occupied and that the city was compelled to rent space in the big skyscraper in the vicinity of the public buildings, they withdrew their request and secured a suite of offices in a building already fairly well filled by various city departments.

Old Wealthy Family.

Miss Chanler, who has been placed in charge of this bureau, is a remarkable product of an ancient and wealthy family. Her standing in a social way entitles her to occupy a position far up near the top of the "400," and her wealth would enable her to maintain this place in a fitting manner. But she does not care for the whirl of social life and her money has given her less pleasure than the results attained by her activity along lines that are peculiarly her own.

When a state of war was declared between the United States and Spain Miss Chanler at once volunteered to serve as a Red Cross nurse without pay. Her offer was accepted and she went to the front with that little band of women under Clara Barton. Miss Chanler proved to be a capable nurse of wonderful energy and at the camp at Montauk Point she received high praise for her work.

During the past few years Miss Chanler has been living quietly in New York devoting much of her time to settlement work. When she was prevailed upon to take charge of the City Hall office of the league, there was much rejoicing among her associates for her acceptance carried with it the assurance that the work would be well done.

Miss Chanler is virtually the executive head of women's part in the control and government of New York. She receives reports from the many branches of the league all over the greater city and acting upon these she makes complaints or recommendations to the Mayor; and sees to it that they are acted upon. On the whole, it is the most systematic attempt to make woman a force in municipal affairs that has ever been attempted.

Speaking of the hopes of the league she said: "The City Hall office will be a sort of a clearing house for the greater body. We expect to have there representatives of all our larger committees who will be familiar with the questions which may arise and who can act speedily. For instance, should a complaint be made that the streets in a part of the city were not being cleaned properly the representative of our Committee on Streets could present the facts to the Street Cleaning Commissioner.

Fighting for Pure Air.

"The Mayor has taken a decided interest in our work and has promised to aid us as far as he can. Already, he has made several suggestions, and we are working upon them at the present time. It may interest you to know that the women have taken a great interest in the movement to abolish the Park Avenue Railroad Tunnel. We sent a petition signed by thousands of persons to Albany protesting against the use of smoke in the tunnel and we shall continue the fight until the unhealthy tunnel is gotten rid of."

The Women's League, which is made up of many of the most prominent and public-spirited women in New York, has

these officers: President, Mrs. George Cabot Wildè; vice-president, Miss Margaret Chanler; secretary, Mrs. P. R. Reynolds; treasurer, Miss Grace Dodge. These are all names of distinguished families and are persons of education, refinement, tact and remarkable efficiency.

WOMEN'S PATRIOTIC SOCIETIES

MRS. CHARLES W. FAIRBANKS president-general of the National Society of the Daughters of the American Revolution, came out in defence of women's patriotic societies in a paper entitled, "What Women's Patriotic Societies Have Accomplished." The gifted wife of Indiana's senior United States Senator says:

"That the busy men of this nation should look with something akin to tolerance upon the work and value of women's patriotic work is only to be expected.

"These organizations, as it were, are merely tolerated by men. They seem to think their women folk are out of mischief when attending the meetings of a patriotic society. The newspaper world gives space to the description of their conventions with the good natured intention of extracting amusement from the proceedings.

"The patriotic organizations of women have done much for the nation. During the past dozen years they have encouraged timely legislation to preserve the flag from abuse. They have inculcated patriotism in the young. At their suggestion the public schools have revived the presentation of object lessons in patriotism.

"For example, when the women's societies had encouraged the idea of flying the flag from public school buildings, it was deemed sufficient to present a banner to a school, to hoist it at a meeting where much oratory was expected, and then to leave the flag flying in wind and weather, a forgotten emblem. The general practice of floating the flag over schoolhouses is of such recent origin that all remember the crusade in its behalf. The women, however, did not relinquish their efforts with the accomplishment of their primary purpose. They continued a campaign of education and set the example of reverence for the national emblem, until now, in a majority of the schools, the brightest and best children are rewarded by membership in the guard of honor of the flag.

"Another good work to which the

women's patriotic societies have devoted themselves is the Junior Republic. Everybody knows the purpose and the good results of this work. In itself, it was essentially a feminine conception. Every mother, indeed every woman, knows that during the period that the man is a boy his instincts should be developed. Therefore, in the Junior Republic, the youth of the country are given an opportunity to study and practice the virtues which will be most decorous during manhood.

To Right Every Wrong.

"The members are taught self-restraint, orderly obedience and acquiescence to the rules of society. They are also taught that if a wrong exists, each and every citizen of the republic should endeavor to right it and not endanger the permanence of good order by rebellion. In the Junior Republic, bright boys learn that law is wise and order necessary. The methods of proper amendment of conditions are realized and the citizen who graduates from the Junior Republic enters upon his manly life equipped as a very knight of progress. His devotion to law and his patriotism are fully developed.

"Flag Day and the foundation of the Junior Republic would be laurels fit to crown the monuments of any society. Herein is practical good accomplished practically.

"When women's patriotic societies began their work there was no dearth of patriotism in the nation; but there was a growing evil which threatened to sap public devotion to ideals. A busy people seemed to forget the ancient firesides of their founders. The women saw these gardens of patriotism neglected. With their own money they bought the homes of many of the revolutionary fathers. These and other historic spots have been preserved that future generations may know the simplicity and rugged manliness of our forefathers. It would be somewhat difficult to ascertain the amount of money which already has been devoted to this good purpose. So little parade has been made of this devotion that few know what great work has been accomplished.

"None of the original States is without some reminder that patriotic women are working to preserve the patriotic instinct in the race.

"It has been asked, satirically, what value have these societies for women in the body politic? Three separate examples of their work have already been given. The work of these societies is not confined, however, to a restricted field. The women are always studying how to inculcate patriotism. The society of which I have the honor to be president-general, has hunted diligently the highways and byways of the land to discover the last remnants of the Revolutionary era. More than a century and a quarter have elapsed since Washington and his soldiers achieved independence. Some of the children of these men still survive.

Hundreds Rescued.

"The Daughters of the American Revolution have faithfully investigated and rescued some hundreds of these women from obscurity and often from penury. Most of us are of the fifth or sixth generation of the fathers of the Republic. It brings us nearer to them to know that

there yet live a few who actually knew the life and example of the Revolutionary heroes, and do not mean to prove themselves unworthy of their ancestry.

"This filial piety on our part is not paraded, but the influence of women who are filled with this zeal, must result in greater patriotism in their own sons. The son of a woman belonging to a patriotic society is not likely to be influenced by the sneer that we are a young nation with no traditional ideals.

"'By our works, ye shall know us.' The flags over the schoolhouses, the Junior Republic, the ease and contentment of the last real Daughters of the Revolution, the monuments over historic spots and in memory of exemplar men, all speak most eloquently for the labors of patriotic American women."

PNEUMATIC ELEVATORS.

Immense Cargoes of Grain Shipped and Unloaded With Surprising Quickness—The Endless Chain.

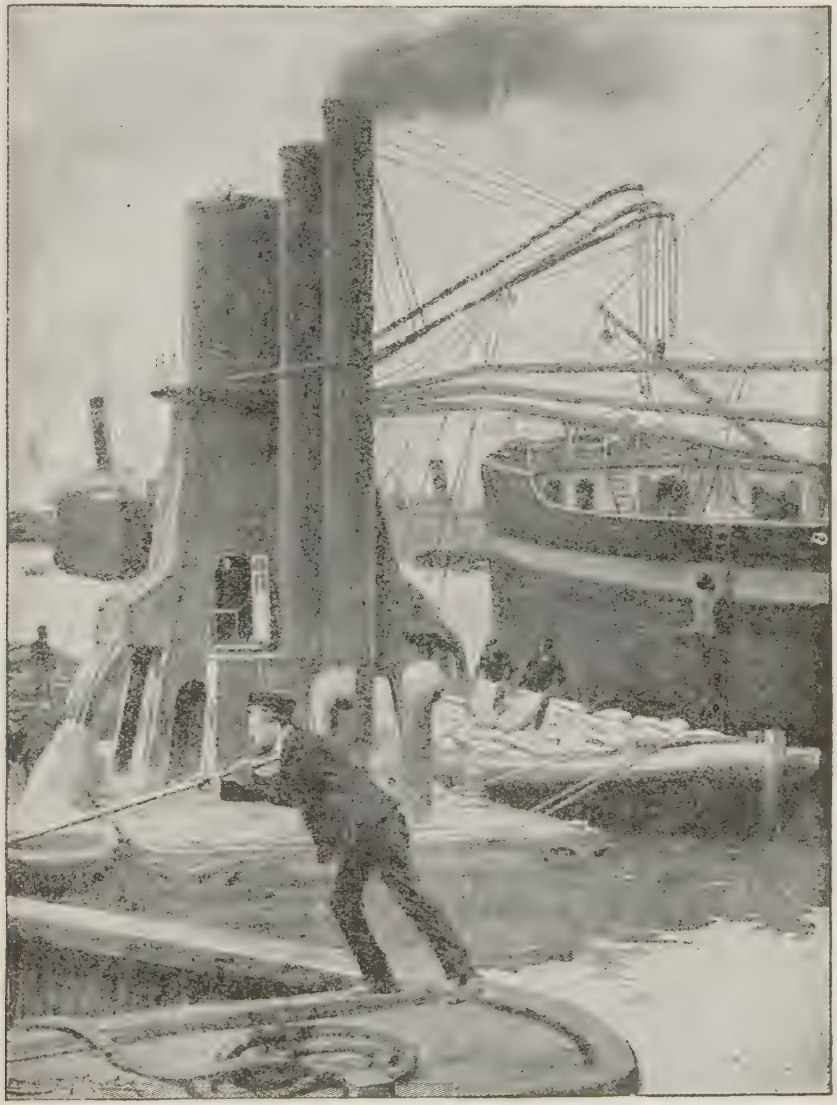
ELEVATORS is the name given, especially in the United States to erections for the transhipment of grain, and in which it is often stored for months, being weighed both when received and when sent out. There are elevators capable of storing a 1,000,000 to 1,500,000 bushels of corn within their walls of wood. The largest are erected at Chicago and Buffalo. The grain on being received at the elevator is examined and graded, all of the same quality is kept together. The farmer or merchant who brings it receives an acknowledgement for so much grain of such a quality; and the grain which is delivered from the elevator on his account is grain of that quality, and not the same as he brought.

In New York, floating elevators are frequently employed to transfer the grain from barges to sea going vessels direct. Fixed elevators are generally built so as to be approachable by vessels on one or two sides, and have tramways running in on the level of the street; the chain of buckets which raises the grain moves, as the case may be, in an inclined plane passing through the wall to a vessel outside, or in a vertical plane into pits into which the grain has been shot from railway trucks. The chain receives its motion from an endless band passing over one or two horizontal shafts in the upper part of the structure, the engine and boiler being located in a building outside the elevator itself.

The cargoes of grain which arrive in London are chiefly discharged, not direct into granaries, but into barges which carry the grain to consignees' premises or to granaries within the docks. The task of getting the grain over the side is very often complicated by the vessel carrying a general cargo as well as grain. The

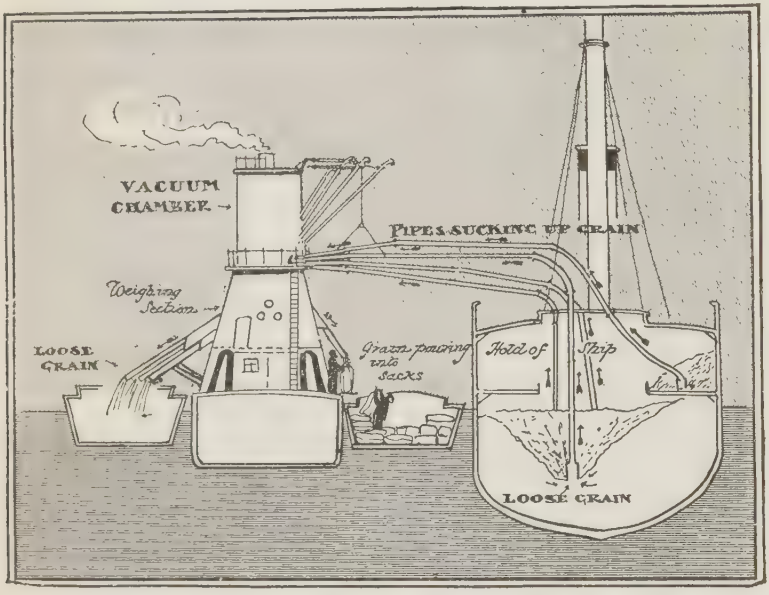
old manual labor has been superseded by several new mechanisms, such as the American elevator and the hydraulic cranes which grab a bucketload of grain between four spade-shaped scoops and then release it at the desired spot. These methods, however, did not facilitate the discharge of any other cargo which the vessel carried. That was a problem that remained to be solved.

A few years ago, however, Mr. F. E. Duckham, engineer to the Millwall Docks, introduced the pneumatic elevator, which with a number of long arms, octopus-like, penetrates to any part of the ship, sucks up the grain through its sealed tubes, and



PNEUMATIC ELEVATOR UNLOADING A CARGO OF WHEAT.

delivers it into the barges in any weather. The air rushing to fill the vacuum caused in the chamber shown in the diagram carries the wheat with it through the specially designed nozzle. Any other cargo can be raised through the hatch at the same time, a matter of consequence in case of a steamer worth $350 a day to its owner. The elevator shown here has a discharging capacity of 100 tons per hour.



HOW PNEUMATIC GRAIN ELEVATORS UNLOAD A VESSEL.

The diagram shows the ship with the loose grain in its hold and the sucking pipes gathering up the grain from different points at the same time. The air is exhausted from the circular chamber, the inrush of air to fill the vacuum bringing with it the grain, which is deposited on the floor of the vacuum chamber. After weighing itself it then flows down on both sides either as loose grain into a barge hold or into sacks. The sucking nozzle cleans up every grain of corn with wonderful ease.

The tide of wheat traffic flows principally from west to east, and from south to north. There are a few exceptions to this, as where America ships to Brazil and China, and Russia and India ship to England and the rest of Europe, but in the main the great traffic is across the Atlantic. The American, while a great bread eater, does not quite forsake his potatoes, and consequently sends his surplus wheat where he can get the best prices. Gigantic as are American projects in general, the calling of the wheat trader commands the admiration of all. The life of the American public depends on the livelihood of the American farmer.

When crops are good general business conditions are buoyant. The man who buys and sells wheat for his vocation deals in such enormous fortunes and with such quantities of the life of nations that the world at large almost bows down to him.

Both the farmer and the trader keep informed as to the exact condition of the markets the world over, and, of course, are ready to take lawful advantage of every turn in the tides of trade. This reaching out, this grasping the ends of the earth and turning them into profitable markets, is a chief feature of modern commerce.

WOMAN PROFESSOR OF PARLIAMENTARY LAW

THE new appointee to the chair of parliamentary law at the University of California, is a woman, Mrs. Urquhart Lee, of Chicago.

Mrs. Lee, who occupies the chair of parliamentary law at the University of California, is the first woman in the country to undertake the teaching of this branch of learning.

She was recommended for the position by ex-Speaker Reed, which in itself was an unusual honor. Mr. Reed followed Mrs. Lee's career closely and frequently heard her argue and clear up intricate points in difficult law cases. She is no novice at her present work. She was president of the Post Parliamentary Law Club, of Chicago, before she took her position in the California University, and through her efforts in that organization became well known to the bench. Mrs. Lee went to the Pacific Coast with high indorsements, aside from ex-Speaker Reed's recommendation. Members of Congress, bishops, mayors of large cities, clergymen, attorneys-at-law, women of note, leaders of commercial bodies, high officials of secret societies who had been led by Mrs. Lee through the mazes of parliamentary law and who had been instructed by her in the science of conducting an assembly, were all enthusiastic in their praise of her.

Hon. Thomas B. Reed, besides speaking in the highest terms of her skill as a parliamentarian, also indorsed her little book on parliamentary practice, which is high praise, indeed, coming from one who himself is the author of a manual of parliamentary rules of order.

"Women are peculiarly fitted to correct parliamentary usage," says Mrs. Lee. "Part of the work is quickness and keenness of mind, qualities in which women excel. There is also a positive value to women in parliamentary practice.

"In the women's clubs it is absolutely necessary for the expeditious disposal of business. But outside of that, parliamentary law gives women the just and judicial mind; it teaches them to do things in order, it corrects the tendency to personal prejudice and does away with the possibility of star chamber proceedings, for the very first lesson in parliamentary law teaches that every member, friend or foe, has a definite right to the benefits of the club and to privileges of the floor."

From under Mrs. Lee's tutelage have emerged some of the most expert women parliamentarians of this or any other age. For some years Mrs. Lee was president of the Chicago Post Parliamentary Club which numbered among its members Mrs. Potter Palmer, Mrs. Ellen M. Henrotin, and Mrs. Cyrus H. McCormick.

NEW SUSPENSION BRIDGE

Largest in the World is Across the East River at New York.
Numerous Tracks for Passengers and Traffic.
Gigantic Marvel of Engineering.

THE population of New York as in the case of London, has not grown at the rate which its inhabitants were disposed to imagine towards the end of the period between the census taking, but it has grown to an extent, especially in the direction of Brooklyn, that has led to a dangerous over-crowding of the old Brooklyn Bridge, finished in 1883, and has rendered the construction of a new bridge to relieve the traffic imperative.

A new bridge was therefore decided upon in 1892, and finally authorized in 1895. The tower foundations on the Manhattan side were contracted for in October, 1896, and completed in September, 1898; those on the Brooklyn side were contracted for in July, 1897, and completed in March, 1899. The New East River Bridge, as it is currently spoken of, is a great suspension bridge similar to the first Brooklyn Bridge built by the Roeblings during a period of thirteen years. It, however, will consume three times the amount of steel and will have a largely increased carrying capacity. Its towers, too, are of steel and not of masonry. They are much higher also than the old towers, enabling the cables to have a greater sag and therefore a greater carrying strength than the older cables.

In fact, the whole bridge is a mass of steel, and but for the masonry approaches is completely a piece of engineering into which the art of the architect does not enter. It will be interesting to observe in the final result whether a sole adherence to questions of mechanical stress will produce an effect pleasing to the eye. In answer to the question of "Why steel towers?" the acting engineer, Mr. O. F. Nicholls, said that it was found impracticable to carry all the tracks and roadways through towers of masonry without making these towers wider and heavier than desirable.

Moreover, a careful study of the problem showed that the use of towers of steel would result in an immense saving in the weight of the towers as well as in the size of the foundations and effect a great economy in time and cost of construction. Masonry towers for the new bridge would necessitate foundations more than twice as large as those actually built and would cost five times as much and require three times as long to build as the towers of steel. The steel towers could be more easily carried to a greater height, and this would diminish the size of the cables by permitting them to have a greater deflection, or sag. The towers rise to a height of 350 feet above the river.

The large caissons for the bridge were

built of wood for convenience in building and handling. They were built on shore and launched like a flat boat, towed into position and weighted down with concrete or masonry to and into the bed of the river. The caissons were 60 by 76 feet in area and were about 20 feet high when launched; a deck or roof near the middle of this height covered the working chamber for the men and received the concrete for the loading and the pier; the side walls above and below the deck were heavily braced with timber.

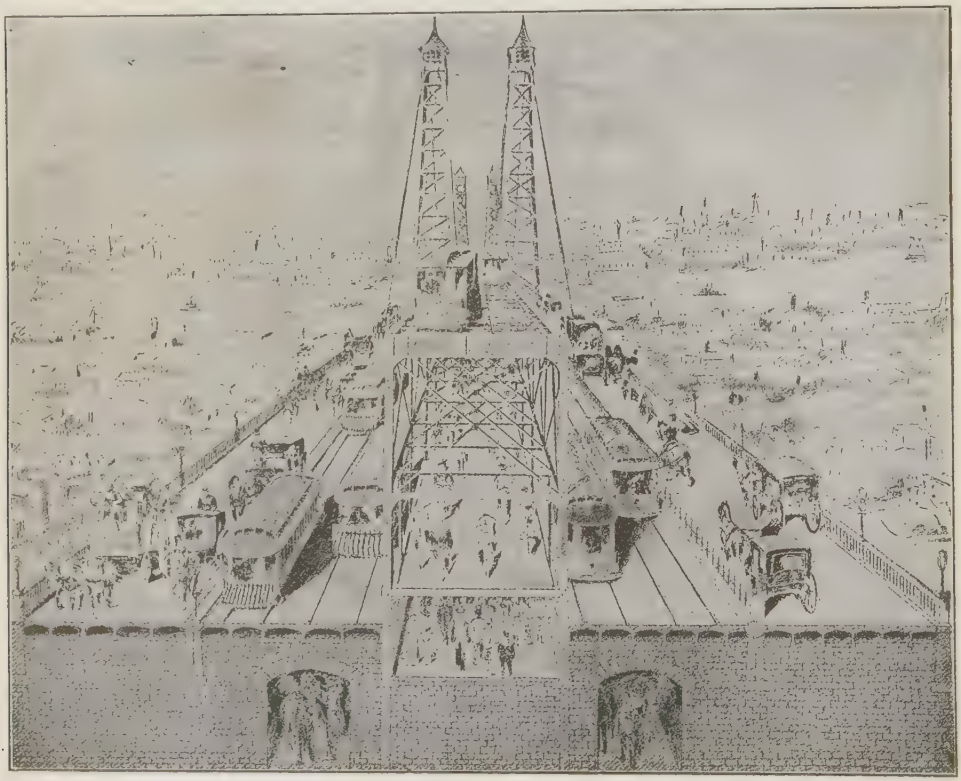
The north caisson on the Brooklyn side was built up and filled with concrete to a height of 52 feet above the lower or cutting edge; above this level the pier was built of stone masonry, a cofferdam extension of the caisson walls serving to keep the water from the masonry. This caisson landed on the bottom in about 55 feet of water.

NEW BROOKLYN AND NEW YORK SUSPENSION BRIDGE, THE LARGEST IN THE WORLD. THIS VIEW SHOWS THE BRIDGE AFTER THE CABLES WERE COMPLETED.

The numerous roadways to which the bridge engineer refers are illustrated in the accompanying diagram. Perhaps the most popular feature of the new bridge will be the bicycle path. This is, in fact, a double path, one part allotted to wheelmen going east, and the other part for those going west, over the bridge. Each section of the path is seven feet wide. This will admit of two riders going

abreast with plenty of room to spare on either side.

The footway comes up on a level with the bicycle paths, and the pedestrians and wheelmen are side by side and directly above the trolley tracks. So carefully



APPROACH TO THE NEW BROOKLYN AND NEW YORK BRIDGE, SHOWING CAR TRACKS, FOOTWAYS, AND CARRIAGEWAYS.

are the approaches to the new bridge planned that every class of traffic—teams, bicyclists, pedestrians, trolleys and elevated trains—divide up and take their proper places without any crowding and confusion.

The entire width of the bridge is left wide at the ends as befits the entrance to a broad avenue connecting the street systems of the two boroughs. Large plazas or open squares are provided to avoid crowding of vehicles of all kinds. The elevated railway tracks pass at a good elevation over this plaza. The cycle paths emerge on to the plaza in a line with the axis of the bridge; the trolley tracks pass on to it outside of the cycle paths and the carriage ways outside of these.

The foundations of the piers were built by means of caissons, which are simply box covers resting on their edges and weighted on top sufficiently to sink them to the bottom. The air pressure keeps out the water from the lower edge. It is simply an extension of the principles of

the diving bell. The main cables which have to be anchored are eighteen inches in diameter, each containing 7,000 steel wires laid straight and parallel with each other. The New Bridge is 7,200 feet long; that is nearly a quarter of a mile longer than the old Brooklyn Bridge. The length of the middle span is 1,600 feet.

Dimensions of the Old Bridge.

The old Brooklyn bridge may truthfully be claimed as one of the finest achievements of engineering in modern times. It is one of the famous sights of New York, and no one can fail to be impressed with its immense proportions, great solidity and strength, as well as the herculean task of constructing it. The work commenced January 3, 1870, and the bridge was opened to the public, May 24, 1883. The total cost was fifteen million five hundred thousand dollars.

The total length from New York to Brooklyn is fifty-nine hundred and eighty-nine feet, and the length of the main span is fifteen hundred and ninety-five and a half feet. The height of the towers is two hundred and seventy-six and two-thirds feet. The height of the floor of the bridge at the centre, above high water mark, is one hundred and thirty-five feet, and the height at the piers is one hundred and eighteen feet. The caisson for the New York pier was sunk seventy-eight feet, and that for the Brooklyn pier forty-five and a half feet below the bed of the river. Each cable is fifteen and three-quarters inches in diameter, and is made up of five thousand wires, each one-eighth of an inch in diameter. The anchorages are nine hundred and thirty feet from the towers, and are capable of sustaining an immense weight.

The new bridge is not the only means of communication which is occupying the attention of New York. The Pennsylvania and Long Island Railroads are going to construct a tunnel through the heart of New York City and under the East and Hudson rivers, which form the eastern and western boundaries of Manhattan Island. It is declared that the tunnel when complete will be the longest in the world. The length of the tunnel will be over fifteen miles.

Soft River Bed.

The most serious difficulty of the undertaking lies in the character of the bed of the North River. Experiments showed that while the bed of the East River is practically hard rock and comparatively easy to tunnel, that of the North River is so soft as to be unable to support such a weight as the tunnel would have to carry. Mr. Jacobs, the engineer, found that for a depth of more than 125 feet below the bed of the North River there is nothing but mud, which hardens as it deepens, but not sufficiently for the foundation which is to sustain the heavy traffic. He, therefore, concluded that this underground passageway will have to rest on pile supports, making what will actually be an underground bridge.

Another project will shorten the sea route to New York by a great many miles and the time of the journey by from four to six hours. The project is to carry a railway out to a distant point on Long Island and there establish piers and docks where the ocean liners could call.

THE ROLLER STEAMSHIP

Unique Method of Constructing a Vessel—Popular Interest in the New French Craft—Radical Change from the Old Style of Steamers.

NO invention involving so radical a change in the construction of steamships has been put before the public since the first steamers were produced at the beginning of the century as the "roller" steamship of M. Bazin, the French engineer. Hitherto the hull of a ship has been built, more or less, egg-shaped, but the "Ernest Bazin" consists of a flat rectangular deck, supported upon twelve discs or wheels. The vessel is small, being only of 274 tons burden. M. Bazin hopes in time to build a steamer large enough to cross the Atlantic.

The "Ernest Bazin" has six floats or wheels; her length is 131 feet and breadth 39 feet. On the deck are the cabins, saloons, machinery and boilers. The whole idea pursued in the construction of the vessel has been the reduction of friction with a consequent increase of speed at a minimum of expense and effort, by rolling through the water instead of cutting through it. Each of the rollers has a displacement of about 45 or 46 tons. The rollers serve, it will be seen, not only as part of the means of propulsion, but also take the place of the hull in an ordinary vessel.

The transatlantic liner which M. Bazin proposes to build is to have four of these wheels instead of three, as in the experimental steamer. The shafts for making the wheels revolve, pass below and across the platform, and, like the wheels, are of steel. M. Bazin argues that in order to obtain a maximum rate of speed there must be a corresponding relation between the rotary force and the propelling force, and his steamer is fitted with two independent sets of engines, one to drive the rollers and the other to propel the vessel forward by means of a screw.

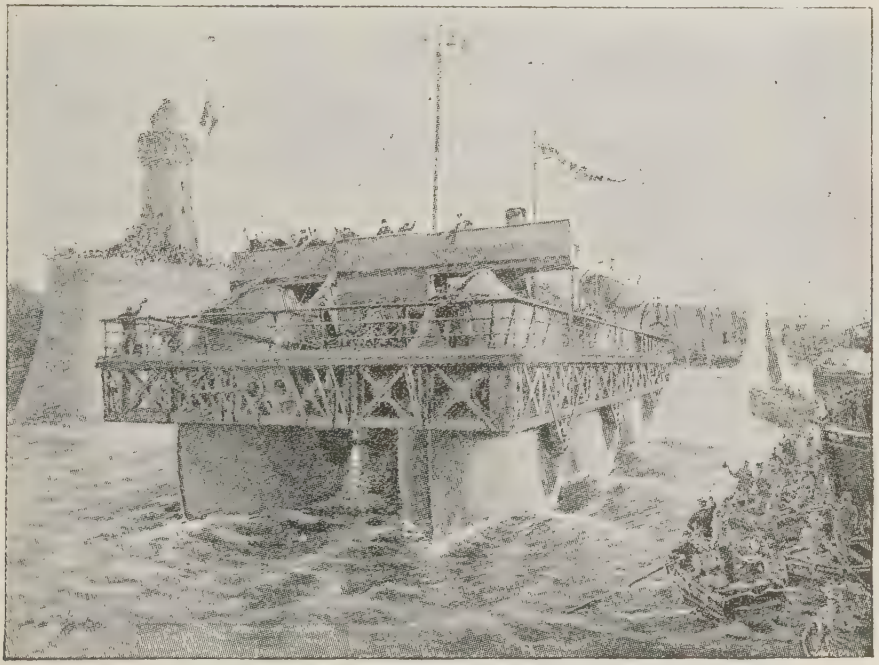
Among other advantages claimed for the vessel may be mentioned the small amount of rolling and the ease with which repairs to the hull can be attended to, docking being unnecessary. Then, again, it is urged that if a wheel is damaged the injury can be made good without stopping the vessel, for the injured wheel and its corresponding wheel on the other side can be stopped while repairs are done, while the others can continue their course through the water.

Ernest Bazin went on his first trial trip from Havre. On board her was Sir Edward J. Reed, who went to ascertain from personal observation how the vessel behaved, and more especially in what degree the speed would be affected by applying part of the available steam power to the rotation of the rollers instead of to the direct propulsion of the vessel.

Sir Edward Reed's report created much interest. The vessel's engines are of 350

horse-power, and these engines work both the screw machinery and the rollers jointly; so that in this vessel of 274 tons displacement there was only about one-seventeenth of the steam power requisite to drive a vessel of similar size at thirty knots, and one-twelfth of that necessary to drive her twenty-seven knots. Nothing but a very low speed could, therefore, be anticipated of the vessel, owing first to her smallness, and secondly to her low steam power. A small vessel is, in Sir Edward Reed's opinion, very unsuited to the application of the Bazin system. The rollers are of necessity too close to each other, and consequently the systems of waves which the onward movement of the rollers creates and sends off on each side of each roller very soon reach each other and cause reactionary turmoil, which is unfavorable to smooth and easy progress, whereas in a much larger ship the progress would be much less interfered with by this cause.

Then, too, so small a vessel is necessarily shallow, and no proper immersion can, under ordinary conditions, be given to the screw propeller, and a screw propeller works at a very great disadvantage when too near the surface. However, in spite of the disadvantages under which the system was tried, the vessel surprised Sir Edward Reed by its performance, and he gives the following results of the experiments made on the trip:



THE ROLLER STEAMSHIP "ERNEST BAZIN."

"We began the trials off Havre with very small power and speed. In the first two measured runs only about 112 horse-power was exerted by the screw propeller engines, giving, with the rollers at rest, a speed of 4.25 knots. Keeping only the same propelling power at work,

but causing the rollers to revolve seven turns a minute by the application of 25.68 horse-power, we obtained a very remarkable increase of speed, which rose over 6 knots. I have calculated what the increase of speed would have been had this 25.68 horse-power been added to the screw engines instead of being applied to the rollers, and I find that by this means we should merely have added .55 of a knot, thus raising the speed from 4.25 to 4.8 knots only.

The Screw Power.

"In the next experiment the power exerted upon the screw was increased to 295 horse-power, and the roller power to 34.2 horse-power, the rollers revolving nine turns per minute. I calculate that with the rollers at rest, the increase of horse-power upon the screw should have raised the speed from 4.25 to 5.8 knots. The actual speed attained was 6.81 knots, giving an excess of speed due to the revolution of the rollers of 1 knot.

"It will be seen that this gain is not quite so much as in the previous case, although the power applied to the rollers was somewhat increased—a fact that may be conjecturally accounted for in several ways; but there remains the remarkable fact that the vessel steaming at, say, 5.8 knots, only with 295 horse-power applied to her screw, is increased in speed by fully a knot by the application of only one-ninth of that power to her rollers. A further, but small increase of speed (from 6.81 to 6.97 knots) was obtained by increasing the power on the rollers to 52.2 horse-power. Small as this increase was, it nevertheless points to the fact that the additional 18 horse-power was much more efficient when applied to the rollers than it would have been if applied to the screw propeller."

In conclusion Sir Edward Reed says:

"There can be no doubt whatever that the experiments conclusively demonstrated that the Bazin rollers furnish an effectual means of greatly reducing the friction which a floating body encounters in its advance through the sea, and friction is certainly one of the most serious of the elements which compose the resistances encountered.

"It does not, of course, remove or evade all friction, for all the ascending and descending parts must of course encounter some friction even in still water; as must also those immersed parts of the roller which are not retreating, so to speak, or moving sternwards, with precisely the same velocity as the ship advances; but, as regards these latter, it must be remembered that all are moving sternwards at some velocity, and therefore all are avoiding to some extent the resistance due to friction. It has been conclusively shown, I think, that on this question of reduced friction, and consequent increase of speed, or decrease of power, M. Bazin's views have been in a general sense fully established."

Good Sea Boat.

The reports of a number of pilots who have had charge of the vessel on various occasions, go to show that she behaves well in a fresh breeze and rough sea, and that she is an exceptionally dry boat and easily handled. This is due to her shape, which is entirely different from the ordinary steamship. The broad surface occupied by the vessel keeps her steady.

A FAMOUS LIGHTHOUSE

That Located at Beachy Head a Remarkable Engineering Achievement.

A LIGHTHOUSE which is one hundred and fifty feet in height stands at Beachy Head on the south coast of England. Building materials had to be carried from the top of the cliff by means of an aerial railway 800 feet in length. The builders traveled in cages made for the purpose, the lighthouse being inaccessible by any other means at high tide. The journey occupied a couple of minutes, in which time the cage traveled from the height of the cliffs out over the rocks and sea down to the level of the lighthouse works.

The Corporation of Trinity House decided to abandon the old Beachy Head lighthouse, a well-known sight to visitors to Hastings and Eastbourne. The old light was situated on that part of Beachy Head known as Belle Toute. The sea had been encroaching upon the cliff beneath, and the light was frequently completely obscured to passing vessels by the fog, which is apt to hang about the summit of the cliff at Belle Toute, 285 feet high.

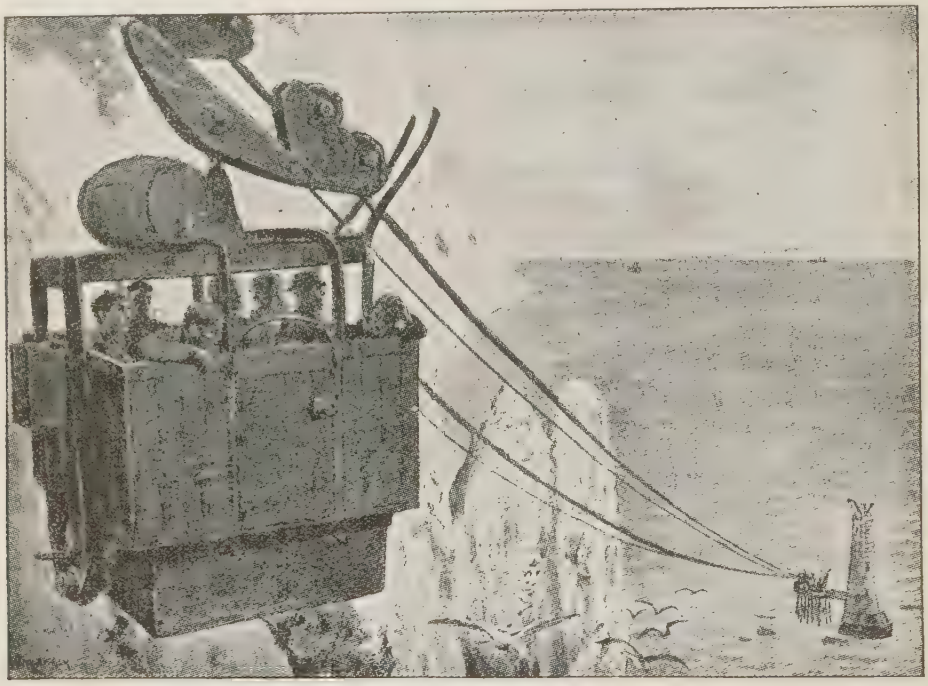
The Trinity House Corporation, which is responsible for the lighting of English waterways, therefore decided that a granite tower upon the foreshore off Beachy Head, a little to the east of the old position, would best serve the purposes of navigation. The works were commenced in 1899, being executed by the Trinity Corporation themselves from the designs of their engineer-in-chief, Mr. Thomas Matthews, and under the supervision of Mr. A. H. Case, resident engineer.

Owing to the position of the new site (550 feet from the toe of the cliff) it became necessary to connect, by means of a wire ropeway, the foundation site with the work yard on the summit of the cliff, which at the selected point is more than 430 feet high. The method of utilizing this ropeway can be seen in our engraving. The strain on the ropes was considerable when the heavy granite blocks were descending to the platform at the side of the foundation works. This strain was taken by steel anchoring cables which were fastened down into the fore shore.

When the cut blocks, which had already been fitted together in the Cornish quarry, arrived at Beachy Head they were carried by a short railway leading to the head of the cableway. Here the block was lifted, and the weight shifted gently to the cable. As the stone descended it raised by its own weight another load on the second cable. At the bottom a crane took the block off the carrier and lowered it into position. Each block was numbered—say 13/5—

which meant that was the thirteenth block in course No. 5 from the bottom. Fifty thousand cubic feet of granite were used, and thirteen hundred cubic yards of concrete hearting filled the centre of theower courses.

Immediately under the lantern there is a service room where the men clean and trim the various parts of the lantern, and below this is a bedroom, then a living room with a closed range for cooking meals. Then comes a storeroom where



THE BUILDING OF BEACHY HEAD'S NEW LIGHTHOUSE. HOW THE CONSTRUCTORS MADE THEIR GIDDY JOURNEY TO AND FROM THE BUILDING.

The lighting apparatus, which is of the first order of power, throws a concentrated beam of light which is visible for seventeen miles. Steamers will recognize the light by its two white flashes every fifteen seconds. The clock to regulate the flash is wound by hand, the weight rising and falling in a tube in the centre of the lighthouse. The apparatus rotates in a mercury trough of the usual modern pattern. There are several rooms in the tower besides the water tanks and coal store in the base.

paint, etc., is kept. Beneath is another store and crane room into which stores are hoisted. Then comes the oilroom, and lastly, the entrance room, where various tackle can be stored. The men will be able to pump up fresh water to the tank in the living room.

The value of having an up-to-date lighthouse at this point is evident to all who are acquainted with the locality. The high bluff, which frequently peers through fogs, has an ominous look to the sailors as they sail by it.

NEW INDUSTRY FOR WOMEN

Girls Learn the Art of Glassblowing—They are Young and Clever, Study Chemistry, and Become Experts.

THE only women glassblowers in America are employed in a very interesting establishment, near Philadelphia. Until these young women began work men had completely monopolized that occupation, but so well have the innovators acquitted themselves that the industry is likely to be revolutionized.

If you wish to see them at work you have only to take a train from Philadelphia, and a half hour's ride will land you at Glenolden, with its great chemical laboratories. There, in a model little factory, you will find thirty maidens blowing the glass vials and tubes which the firm uses for its antitoxin and vaccine virus. The glassblowers are dressed in the daintiest uniforms of striped blue and white seersucker, with snowy white muslin aprons and sleeves, and all wear the most coquettish little beruffled caps on their heads. They are young (from seventeen or eighteen to twenty), and not one of them is other than pleasing in appearance.

Their advent into the trade has been so unostentatious and so quietly brought about that the rest of the world outside of the little village has not heard of it.

The way it came about was this. The H. K. Mulford Company, having experienced the greatest difficulty in getting from other sources a sufficient supply of the various glass packages used in putting up their chemicals, determined that the best solution of the difficulty was to establish a glass plant of their own. The happy idea of having girls to do the work was suggested by the fact that already there were girls employed at the factory in putting up the chemicals, and these in large numbers were needed only at certain seasons of the year. Why not teach them to make glass and so utilize their services continuously? This plan was immediately put into action.

The factory, a long, low house, was built on the prettiest sight that could be found for it in all the thirty acres by which the great plant is surrounded. It is in the summer time the most idyllic spot for labor, in a low green valley by the side of a cool, sparkling brook which splashes over the stones directly beneath the windows, while overhead great chestnut and maple trees wave their spreading branches.

No expense was spared to provide an equipment that should be up-to-date in every particular. An experienced glassblower was employed as manager, and the girls were placed under his direction. Profiting by his instruction, they developed into expert glassblowers.

And the manager is very proud of their skill. "I've been in this business from boyhood up," he declares, "and I know what I'm talking about when I say that no men turn out such good work as these girls do. Glassblowers would be astonished if they looked in on this factory. The girls are infinitely more careful and painstaking than men have ever thought of being, and they are achieving results never before known in the trade."

Native Intelligence.

One reason for the girls' skill is not far to seek. It is found in their natural intelligence. They come from the best families in the adjacent villages. They are well educated, some of them are academy graduates, and are generally the sort of material from which school-teachers might have been made had not this employment appealed to them as more congenial.

It isn't hard work that they have to do. The only disagreeable feature about it is that the factory is unduly warm. Even in winter the thermometer registers sometimes 110 degrees. That they must be intelligent is evidenced by the fact that they regularly attend the bacteriological lectures which are given for the information of the chemists. The girls are required to thoroughly assimilate the information there imparted.

They work from 7.15 o'clock in the morning until 5 o'clock in the afternoon, and Saturdays after 2.30 o'clock is a holiday. The work is paid for by the piece, and the earnings are from $4 to $12 a week, according to their speed.

The champion glassblower among them is Miss Anna Agnew, who enjoys the distinction as well of being the champion woman glassblower of the world. She is just 18 years old. Her record is 300 test tubes a day. Miss Agnew says that she enjoys the work. "I like it," she declares "and we all of us like it. It doesn't affect our lung expansion. My chest has developed several inches since I began glassblowing."

Each girl operator is seated on a low stool before a table of her own. These tables are built in rows, with partitions between so that each is a compartment by itself. Each compartment is fitted up with a Bunsen burner, the flame of which is crossed by four other flames, these being directed by four jets of air, which are forced across four other gas burners. The centre of the flame thus formed develops a white heat in which the operator holds the glass she is shaping.

What They Make.

The glass tubing, amber and white, from which the small articles are fashioned is purchased in bulk. Out of it the girls blow small vials of various sorts and glass bulbs to hold antitoxin. They make also capillary glass tubing, the very fine tubing in which vaccine virus is put up; vaccine points of glass, and small glass tubes, which are known as "point covers."

The vials and bulbs begin with the cutting up of the tubing into four-inch lengths. A girl takes these, and by drawing them over a glass edge marks them in the centre. Another girl takes the marked tube and holds it in the flame until it melts in two pieces, when she seals up the end, making the end round by blowing through from the opposite extremity.

Bulbs are made also by heating the tubing till it is soft at the centre, then blowing through the end, which operation inflates the soft section into globular form. The vaccine points require no blowing, but are made by heating narrow tubing until it is soft and then drawing it out to a point. The point covers are made by pinching one end of a heated section of tubing until it closes.

An interesting operation is the making of the capillary tubing through which the opening is a very small fraction of an inch. The girl heats a section of tubing in the flame before her until the centre is soft. She then holds one end of the hot glass while another girl takes the other end and walks with it a distance of twelve feet, pulling the heated soft centre out into that length of fine tubing.

The output of the little glass factory is used in the company's laboratories exclusively. The product amounts to more than a thousand gross of vials and bulbs a month, all of which are immediately shipped for use.

FAMOUS BANK.

Notable Financial Success—Thorough Organization and Delicate Machinery.

THE Bank of France, the ancient hotel de la Vrilliere, is situated in the street of that name. It was built in 1620 by Mansart, was restored in 1749 by Robert de Cotte and has been considerably enlarged since. The bank is said to date from the year 1803. Other banks under different titles had existed before that date such as Law's Bank established in 1716. That collapsed four years afterwards, causing the ruin of very many families; and the other banks that were founded half a century later met with indifferent success.

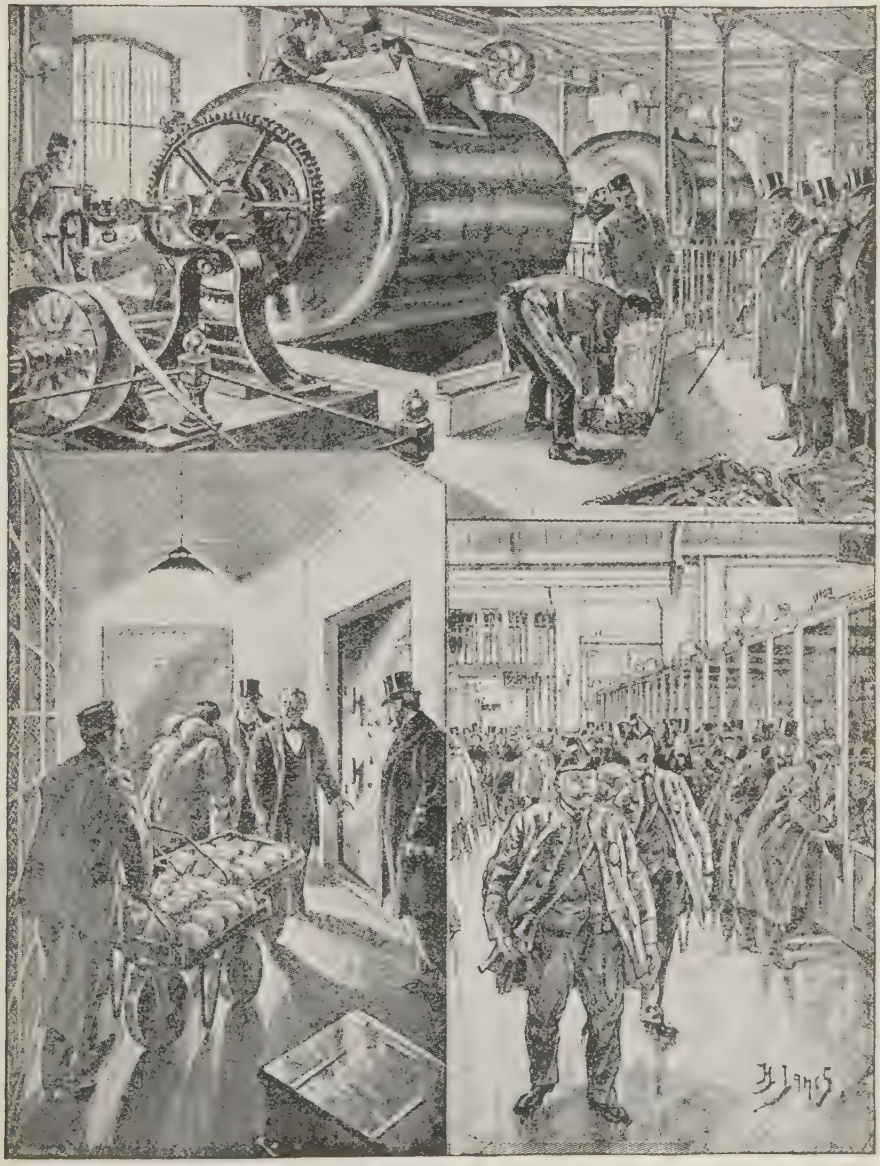
The Bank of France when it was established may be considered as a fusion of all the other cash discount offices which then existed in Paris. By laws passed since its establishment the bank now holds the exclusive right to issue notes. A visit to the bank should certainly be included in the list of things not to be missed by those who wish to see Paris of to-day. No one could fail to be impressed with the perfect organization of the enormous amount of business to be dealt with, for in Paris there is a far greater tendency for all business to be centered in one bank than there is in our own country.

Our illustration, as the reader will note, comprises several buildings. One of these shows the final operation in the making of bank notes, namely, the

stamping of the signatures on them. This is done on three little machines specially made for the purpose and done like any other machine. Each is managed by an attendant and behind the three machine men are seated three ladies—the Bank of France employed ladies before the Bank of England or our Treasury Department in Washington thought of doing so. The duty of these ladies is to see that the notes are well stamped with the signatures in the right place. The notes when passed are made up in packets for use.

A VISIT TO THE BANK OF FRANCE.

All the specie received in the bank by the cashiers is brought in bags on little trucks, which run on wheels to the chief cashiers office. From there it is taken to the strong room in the vaults below the bank. The strong room is guarded by a stout steel door, to which three separate locks must be turned. These three locks are always undone by three separate officials, no one man being allowed to handle more than one key. The door of the strong room opens into a narrow room large enough to contain three or more people. On the right is a stone



INTERIOR VIEW OF THE BANK OF FRANCE.

staircase leading to a labyrinth of narrow passages in which are stored the bags of specie.

Our illustration shows the messenger bringing a truckload of specie to the strong room and waiting for the door to be opened to deposit the bags in their proper place. Another sketch depicts the crowd of business men taking up on the evening of the date when they are due, bills that have not been paid on presentation earlier in the day. Behind a grill are the collecting clerks who have presented the bills and have returned from so doing. The clerks are seated according to the districts in which their bills were payable. A ticket above each opening in the grill indicating the district of each, and the men who come to take up their acceptances form a line according to the tickets above the openings.

Destination of the Notes.

Visitors to the bank having been shown the machinery for the final process in the making of a bank note will be interested in seeing what is the ultimate destination of the notes. The notes having been in circulation for various periods of time ultimately find their way back to the bank and as in the Bank of England and in our Treasury Department at Washington a bank note when once returned is cancelled and not issued again. The cancelled notes are taken periodically—once or twice a month—to the destroying room. Here are large cylinders filled with chlorate of soda, the interior of which is fitted with rakes and hooks, which tear the notes up and turn them into pulp, while the chlorate of soda removes by bleaching the printing on them.

The notes are brought in baskets to the destroying room and are emptied into the cylinders in the presence of bank officials. In old time the cancelled bank notes used to be burned. But the present system was intended to save the waste and to obviate the complaints of the bank's neighbors about the smoke.

The cancelled notes are stored in vast rows of pigeon holes. There is the row for 1,000-franc notes, one for the 500-franc notes, one for the 100's and another for the 50's. These rooms are reached by strong steel doors, every precaution being taken against fire. Firemen in their rounds visit each department of the bank. All day and all night the firemen go their rounds, touching the buttons of the various dials to show that they have done so.

United States Money.

In the United States the bank notes at present in circulation are manufactured by the government bureau of engraving and printing, the paper being made by a private concern under a patented process, the chief ingredients being a mixture of linen and cotton fibre, into which are introduced threads of silk, so arranged as to be perceptible after the notes are printed. This style of paper is furnished only to the government.

Superior skill is exercised in engraving the plates, nearly all parts of them being executed by the geometrical lathe and the ruling engine, the work of which it is impossible to imitate successfully by hand. The printing of the notes is done in colored inks of the best quality, sometimes as many as four shades being used, the impression being clear and distinct.

WHITNEY'S COTTON GIN

An Invention that Revolutionized a Great Industry. Story of Its Construction.

BEYOND all doubt or question, the invention of the cotton-gin, just at the close of the eighteenth century, was an event which most wonderfully accelerated the high career of the United States, in an industrial point of view, and, indeed, revolutionized, by an extraordinary impetus, the manufactures and commerce of the world. It may be regarded, in a word, as the first key which was applied to the unlocking of these wondrous natural capabilities of the new-born republic, the continued development of which has given her such a foremost place, in respect to material and political power, among the nations of the earth.

So direct is its identity with facts and causes which have led to the country's prodigious progress during its national history, that he who would trace to their primary source—with even ordinary philosophical acuteness of judgment—those momentous events, whether material, political, military, or social, which have distinguished the greater part of our country's career, may well pause longest and take his latitude at this point.

Such, indeed, is the greatest national consequence accorded by historians to this machine, that, of the thousands upon thousands of inventions and discoveries recorded in the Patent Office at Washington, many of them, of course, of almost incalculable value, only some half a dozen, or less, are comprised in the "chronology of important dates." First among the triumphs of American ingenuity thus made conspicuously historical, is the invention and introduction of the cotton-gin, in 1793, which is the subject of this article. That it should have a place among the few of its kind capable of coming within the plan and scope of this volume, will be at once apparent.

Before entering into the more elaborate details pertaining to this remarkable machine and its bearing upon American industry and commerce, it may be useful to give, in the first place, a sketch in brief of the career of Eli Whitney, whose genius gave to his country, and to mankind, this great boon. At an early age, he gave indications of that mechanical and inventive talent, for which he was afterwards so greatly celebrated. His father was a farmer in Westborough, Massachusetts, a village where only the ordinary advantages of a common school education were available.

But Mr. Whitney was desirous of the benefits of a more complete course of instruction, and at the age of twenty-three entered Yale College in New Haven. He received the honors of this institution in 1792, and soon after went to Georgia, in the expectation of opening a private

school, and devoting himself to that profession. In this expectation he was disappointed, for, on arriving at the place of his destination, he was informed that another tutor was already filling the station he expected to occupy.

Having traveled from the North, to Savannah, in company with Mrs. Greene, the widow of the Revolutionary general and hero of that name, he received from that lady a courteous invitation to make her house his home, while engaged in his course of studies preparatory to entering the legal profession. This most favorable offer, so timely in view of his shattered health and scanty means, he gratefully availed himself of.

His First Idea.

It was on the occasion of a social gathering of some neighbors and others, one afternoon, at the residence of Mrs. Greene —a party including several planters of distinction, a few of whom had served as officers under General Greene's command —that Whitney first resolved to rouse his genius to its utmost accomplishment.

Among other remarks made by the gentlemen present, on the occasion referred to, was one in regard to the depressed condition of the agricultural interests of Georgia, namely, that since all the lands in that region, not suitable for the cultivation of rice, were eminently favorable for the production of heavy cotton crops, it was exceedingly to be regretted that no means existed of cleansing the green seed-cotton, or of separating it from its seed, in a manner sufficiently thorough to make it profitable—it being almost useless, in the absence of such a method or contrivance, to undertake to grow cotton crops for sale, because only a pound of this green seed-cotton could be cleaned and made merchantable, per day, by a single laborer, and the price obtainable for it, when thus prepared, was but a few cents per pound.

In response to these suggestions, Mrs. Greene, with true womanly perceptions, and knowing Whitney's ingenious turn of mind in the sphere of mechanics, naively remarked, "Well, gentlemen, apply to my young friend, Mr. Whitney—he can make anything;" and, suiting the action to the word, she led them into the room where her tambour or embroidery-frame was kept, together with some other ingenious contrivances, and exhibited them to the company as evidences of Whitney's singular skill. On being introduced to these gentlemen, and entering into conversation with them on the subject, Mr. Whitney was obliged to inform them that he had never seen cotton nor cotton-seed in his life!

A Sure Triumph.

In a few months he had advanced so far and so successfully with his machine as to leave no doubt of his having achieved a complete triumph. In acknowledgment of Mrs. Greene's many and valued attentions to him during his labors, and her steadfast interest in his fortunes, the gratifying privilege was accorded her, on a day duly appointed, of exhibiting to an invited assembly of guests, principally planters, a model of the saw-gin that was to produce such a mighty change.

Their astonishment was almost unbounded, when, on examining the principle and working of the instrument, they

found that more cotton could be separated from the seed in one day by the labor of a single hand than could be done in the usual manner in many months. Enthusiasm over such a result, and in view of such a prospect, was very natural.

Excited Great Interest.

The report of Mr. Whitney's invention spread very rapidly throughout the South, exciting intense interest, and the planters in especial were eager to see a machine that promised such incalculable benefits to themselves and to the nation. For a time, however, Whitney declined showing the gin, as it was not entirely perfected, and because it might be imitated by others, and he be deprived in that way of his right to a patent.

But so great was the excitement to which the people had been wrought up, and so tempting was the chance which presented itself to the unprincipled to appropriate to themselves the fruits of other men's toils, that the building in which Whitney carried on his labors was actually broken into one night by a party of lawless individuals and the instrument secretly carried off. Thus it was that several machines were constructed on the basis of Whitney's invention, and indeed, varying but little from the original, though it was artfully attempted to have the deviation sufficiently obvious to escape the penalties of imitation.

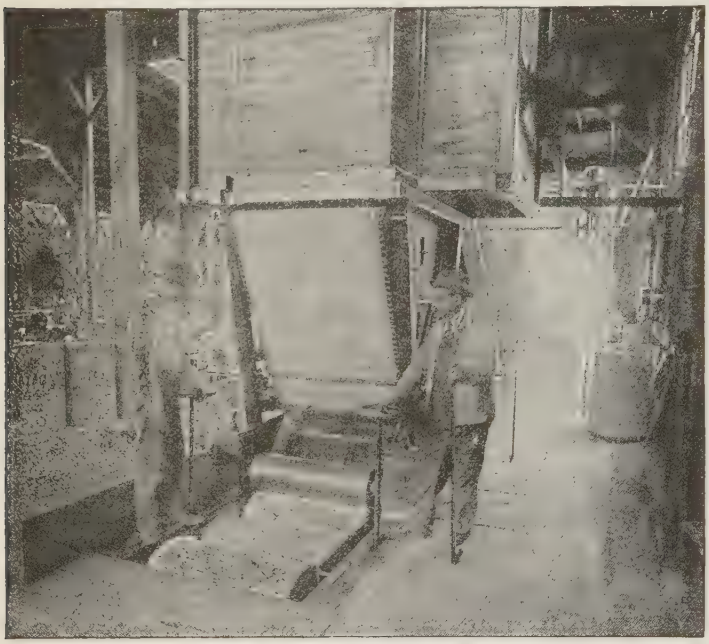
It may well be supposed that the various lawsuits growing out of the infringements upon his rights was an exhausting draft upon Mr. Whitney's funds. But, in addition to this drawback upon his enterprise, there befell him the successive calamities of prolonged sickness, the destruction of his manufacturing establishment by fire, and, worse than all, the assertion on the part of certain unfriendly persons, that the use of the machine ought to be abandoned because it greatly injured the fibre of the cotton. The testimony of some of the British manufacturers was industriousiy circulated to the effect that the old roller-gin, which ground the seed to impalpability, was preferable to that which separated the seed from the staple at the sacrifice of its quality.

And here it may be of interest to state, that, in order to overcome the difficulty of separating the seed from the wool by hand, a huge hand-mill or roller-gin, was, at an early period, substituted in some parts of India and China, by which from forty to sixty-five pounds could be cleaned in a day. After this the cotton was further cleaned from dirt and knots by "bowing." A large bow was placed in a heap of cotton; the string was made to vibrate powerfully, thus dispersing and cleaning the heap. These means, employed from remote times in eastern countries, were also formerly used by American growers.

Process Described.

Much of the sea-island cotton is still separated from its seeds by rollers constructed on a large scale, and worked by horses, steam or water. These rollers are of wood, and revolve rapidly in contact with each other; as they do so a sort of comb with iron teeth acts on the cotton as it passes between them, and detaches the seeds, which fly off like sparks in all directions. Particles of seeds which escape and pass through with the cotton are removed by hand. The cotton is then

whisked about in a light wheel, and when well winnowed it is conveyed to the packing house, and forced into bags by means of screws until each bag contains the requisite number of pounds.



ROUNDLAP COTTON BALE COVERED READY TO BE REMOVED FROM PRESS.

But short-stapled cotton cannot be properly cleaned by this process; the seeds are so firmly attached to the wool that a powerful machine is needed—and here the utility of the saw-gin over the roller contrivance is manifest. The cotton is put into a long and narrow hopper, one side of which is formed by a grating of strong parallel wires, one-eighth of an inch apart. Close to the hopper is a roller set with circular saws an inch and a half apart. These pass within the grating of the hopper and seize by their teeth on the cotton, dragging it through the wires, which are not wide enough apart to allow the seeds to pass also.

The cotton is afterwards swept from the saws by a revolving cylindrical brush. Thus the separation is effected in a cheap, easy and rapid manner. At first Whitney used bent wires, or teeth, like those of the common card, but much larger and stronger, and these were placed in rows on a revolving cylinder. The cotton was separated from this cylinder by a frame of parallel wires; as the cylinder revolved, the teeth extending through the wire frame caught the cotton and drew it through the grating, but the seeds, being too large to pass between the wires, were of course separated from the fibre.

So serious an objection as that brought by the British manufacturers, namely, that the operation of this machine injured the quality of the cotton was a most disheartening one to Mr. Whitney and his partner, Mr. Miller, for on its truth or falsity their fortune and fate depended. For a time the process of patent ginning was quite at a stand; and, indeed, little was heard of it by the originators, except the condolence of a few real friends, who expressed their regret that so promising an invention had entirely failed.

Of the inventor's state of mind, as well as the condition of his purse, at this time, some idea may be formed from a letter written by Whitney, in the autumn of 1797, in which he says: "My closest attention has been directed to our busi-

ness. I have sacrificed to it other objects, from which, before this time, I might certainly have gained twenty or thirty thousand dollars. My whole prospects have been embarked in it, with the expectation that I should, before this time, have realized something from it."

The Machine Appreciated.

Against all opposition, the machine finally became appreciated according to its merits, and, though the country was flooded with imitations—against the manufacturers of which it seemed almost impossible to obtain any redress or protection in the courts of law—a large demand set in, and Whitney's golden visions appeared likely to be realized.

At the suggestion made to them by some of their business friends, Miller and Whitney were induced, in view of the public benefit that would accrue to the cotton-growing States, by the general and inexpensive introduction of the saw-gin, to offer the exclusive disposal of the machine in South Carolina to the legislature of that State, which offer was finally accepted; the sum paid to the inventors, for this privilege, being fifty thousand dollars.

Though this sum was only one-half of that which had originally been fixed upon by the patentees, it seems to have given quite a zest to Mr. Whitney's feelings and anticipations, for he wrote in relation to the new arrangement: "The use of the machine here (in South Carolina) is amazingly extensive, and the value of it beyond all calculation. It may, without exaggeration, be said to have raised the value of seven-eighths of all the three Southern States from fifty to one hundred per cent. We get but a song for it in comparison with the worth of the thing; but it is securing something. It will enable Miller and Whitney to pay all their debts, and divide something between them. It establishes a precedent that will be valuable as respects our collections in other States, and I think there is now a fair prospect that I shall in the event realize property enough to render me comfortable, and, in some measure, independent."

It was not, however, without much trouble and litigation, that Whitney realized the fulfillment of this contract.

Struggle for His Rights.

But the expense involved in numerous suits at law against the encroachers upon his patent, was more than the profits yielded by the sales, and these struggles and expenditures, and constantly recurring discouragements, sent Mr. Miller to a premature grave, at the close of 1803. In the year 1812, Mr. Whitney applied to Congress for a renewal of his patent, in the hope of still receiving some substantial benefit from his invention. But the southern delegation generally—though with some honorable exceptions—were opposed to it; which was of course the more unexpected, as well as wounding, in view of the immense advantage of the machine to that part of the United States.

In regard to this last-mentioned point, no testimony could be more weighty or emphatic in the affirmative than that by Judge Johnson, an eminent South Carolinian, and, at the time of speaking, a judge of the United States Supreme Court: — "The whole interior of the

Southern States (these are the words of Judge Johnson, as judicially uttered) was languishing, and its inhabitants emigrating for want of some object to engage their attention, and employ their industry, when the invention of this machine at once opened views to them which set the whole country in active motion. From childhood to age, it has presented to us a lucrative employment. Individuals who were depressed with poverty, and sunk in idleness, have suddenly risen to wealth and respectability. Our debts have been paid off. Our capitals have increased, and our lands trebled themselves in value.

"We cannot express the weight of the obligation which the country owes to this invention. The extent of it cannot now be seen. Some faint presentiment may be formed from the reflection that cotton is rapidly supplanting wool, flax, silk, and even furs, in manufactures, and may one day profitably supply the use of specie in our East India trade. Our sister States also participate in the benefits of this invention; for, beside affording the raw material for their manufacturers, the bulkiness and quantity of the article afford a valuable employment for their shipping."

Its Wonderful Value.

Such was the testimony borne by the highest possible authority, in regard to the wonderful value and effect of this invention. And yet, though full a dozen years had elapsed since Whitney had staked his all upon the machine, and was even now pleading for redress against the piracies committed upon his rights and property, he was actually a poor man, struggling against remorseless fate. Mr. Whitney, in a letter almost pathetic in its rehearsal of his wrongs, addressed to Robert Fulton, the inventor of the first successful steamboat, remarks, that "the difficulties with which he had to contend originated, principally, in the want of a disposition in mankind to do justice. The invention was new and distinct from every other; it stood alone. It was not interwoven with anything before known; and it can seldom happen that an invention is so strongly marked, and can be so clearly and specifically identified; and I have always believed that I should have had no difficulty in causing my rights to be respected, if it had been less valuable, and been used only by a small portion of the community, as such is apt to be the history of important inventions.

Many Trespassers.

"But the use of this machine being immensely profitable to almost every planter in the cotton districts, all were interested in trespassing upon the patent right, and each kept the other in countenance. Demagogues made themselves popular by misrepresentation and unfounded clamors, both against the right and the law made for its protection. Hence there arose associations and combinations to oppose both. At one time, few men in Georgia dared to come into court and testify to the most simple facts within their knowledge, relative to the use of the machine. In one instance, I had great difficulty in proving that the machine had been used in Georgia, although at the same moment, there were three separate sets of this machinery in motion within fifty yards of the building in which the court sat, and also near that the rattling

of the wheels was distinctly heard on the steps of the court house."

Surely, few men of genius have rendered so great benefits to their country, by means of an invention, who have been so heartlessly treated and so poorly remunerated. Despairing of ever realizing an adequate return therefore for his cotton-gin, Whitney applied his inventive skill to the improved manufacture of firearms, in which he was very successful, and, having obtained valuable contracts from the government for his improved muskets, he ultimately acquired a fortune —a strange but most deserved sequel to his hitherto checkered career.

The progress and value of the cotton production in the United States, under the impetus given to it by Whitney's invention, may be characterized as simply prodigious; and, in the mind of the philosophic statesman and student, the story of the cotton-gin will forever weave itself, most intimately and wonderfully, with those great themes and events which make up the nation's history.

QUEEN OF THE WATER LILIES

The World's Most Gigantic Flower is the Victoria Regia— Marvelous Product of the Vegetable Kingdom.

THE queen of the water lilies is the Victoria Regia, which is found in the still water of the tropical South American rivers. Similar to our white water lily, it attains a large size. Its leaves are thorny upon the underside and purple in color. The plant is largely cultivated in hothouses.

Its leaves are peltate, circular in outline, float upon the water and attain a diameter of 5 to 6 feet, have the margin turned up all around about 2 inches high, and on the under side exhibit a sort of wicker work of very prominent veins furnished with prickles. The flowers rise amongst the leaves upon prickly stalks. They are more than a foot in diameter, white internally, rose-colored and are very fragrant. The fruit is a capsule almost globose, with a depression on the top about the size of a man's head, fleshy within and divided into numerous cells full of round farinaceous seeds which are an agreeable article of food. The plant is therefore called the Water Maize in some parts of South America.

To the cultivation of this plant special hothouses have been devoted at Kew, Chatsworth, Crystal Palace and other places in Britain, and elsewhere in Europe and America, and it was successfully

cultivated and flowered in a heated tank in the open air in a nursery at Chelsea in 1851 and a few years subsequently. It has been introduced into India from seeds produced in England.

where the roots of the plant are imbeded. This shows the height to which the stem will grow. Altogether this is the most marvelous product probably of the vegetable kingdom. The writer of this has seen

VICTORIA REGIA, THE LARGEST BLOSSOMING PLANT.

Our illustration shows the size and strength of the plant from the fact that the blossom sustains the weight of a boy seven years old without breaking. The head of a man appears above the water. His feet rest on the bottom of the pond

the Victoria Regia in the Kew Gardens a little out of London. It is one of the curiosities of the place and always attracts much attention from visitors.

It is not after all the size of a plant that gives it a conspicuous place in the vege-

table world. Our little modest violet, the snowdrop, the lily-of-the-valley and other products sung about by poets, have their peculiar charms, but as an example of what nature can do in the production of a plant of gigantic size the Victoria Regia is without a parallel in the vegetable world.

SCENES IN NATURE

Aurora Borealis—Swift Comets—Snow Crystals—Mock Suns—Great Geysers—Arctic Mirage—Saint Elmo's Fire—Above the Clouds—Spectre of a Swiss Mountain. Fata Morgana.

THE commonest scenes of this wonderful world of ours are often the most lovely. A sunrise at sea or a midnight thunderstorm, a newly fallen snowscape or a full moon lighting up a distant stretch of country, all excite little wonder because they are often seen. There are others just as natural, but because they are far rarer are more startling, and once filled the hearts of men with terror and foreboding. A total eclipse of the sun, or a flaming aerolite, filled them with dread; a comet they thought foretold war, plague or death.

We have collected on our picture a few of these marvels, which we shall proceed to describe.

Parhelia, or Mock Suns.

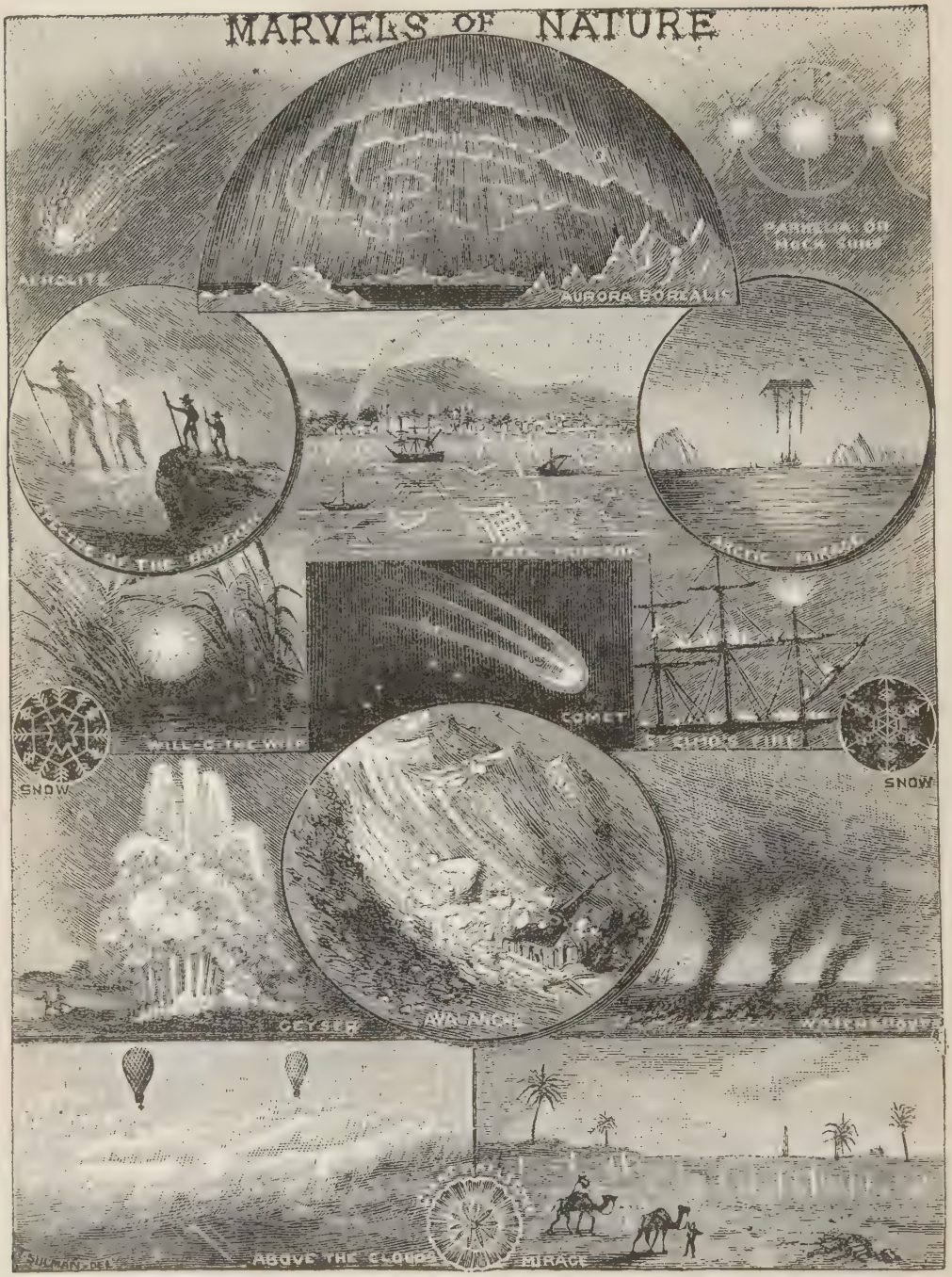
If two pieces of looking-glass are held on the opposite sides of a lighted lamp or candle, an endless scene of bright flames may be seen at one time. So, in the cold north, when the air is full of minute floating ice-flakes, the sun with its halo is reflected many times, and the traveler sees two, four, or more mock suns with crossing halo-rings of startling patterns.

Arctic Mirage.

Another wonder of the icy north is that clouds of frozen moisture in the sky have sometimes the telescopic effect of bringing distant objects near. Ships are seen reflected in the sky that are really far away. They appear upside down, and distorted in shape. Sometimes there are several images of the same ship.

The Aurora Borealis.

or Northern Lights, are now thought to be an electric display. In the arctic



shores of Siberia or of Greenland brilliant flashing streamers of rosy light fill the sky; sometimes they appear as pink clouds, sometimes they are folded together like fantastic curtains of soft fire, and illumine the darkest night.

The Spectre of the Brocken.

In hilly countries, when the sun rises in a serene atmosphere, but opposite to a thin vaporous cloud, if a human being stand on a very high hill between them a wonderful image is seen on the cloud-curtain, moving as the man moves, at one moment clear, the next fading away.

This is a kind of natural image-lantern, where the cloud takes the place of the white screen, and the man, or men, of the slides. The highest peak of the Hartz Mountains, called the Brocken, is the place where it is oftenest seen, so the image is called the spectre of the Brocken.

The Fata Morgana

is another sunrise marvel seen in the Mediterranean. When the sea is glassy smooth a man standing with his back to the east sees towers, churches, ships, trees, herds of cattle, moving confusedly in the deep water. All these images are mingled like the hues of painted glass in a kaleidoscope. The Sicilians of Messina are not at all alarmed at the sight; they run down to the shore crying, "Fata Morana!" or "Morgan is at work"—Morgan being the magician in Aristo's famous poem This wonder is very rare, but is only distorted reflections of natural objects.

Mirage.

Few travelers in the hot deserts of Africa and Central Asia fail to see startling effects of mirage, caused by the heated strata of air, which appear to be sheets of water, rivers or lakes. Not only the traveler, but his horses and camels are deceived. It seems impossible that the great expanse they behold is not water. The reflections of palm trees and rocks are so clear and lovely that the fancy paints houses, domes and gardens on the other side of the mocking lake, and the tired travelers press on to find them vanish, leaving only plains of burning sand and deep despair

St. Elmo's Fire.

Electricity explains many truly startling sights, as when the masts and spars of ships are sometimes seen fringed with blue electric fire, balls of lightning appear to roll along the yards, and sailors sent aloft feel their limbs tingle with the electric fluid. When this is seen a storm is presaged. The Italians call it St. Elmo's Fire.

The Will o' the Wisp

or the ignis fatuus, is to-day a very rare sight. It is a meteor or light that appears in the night over marshy grounds, and supposed to be occasioned by the decomposition of animal or vegetable substance, or by some inflammable gas.

Aerolites, or Shooting Stars

are known to be fragments of stone, generally of small size, attracted to our earth in their journey through space. Their immense speed causes them to take fire in passing through our atmosphere. Sometimes they explode with a noise like thunder, and leave a train of light behind them like a rocket.

Comets

are still not a little mysterious; but astronomers can tell us much about them. They visit our sun from outside space, growing brighter as they draw nearer; their tails are millions of miles long, and are sometimes double and threefold. They often remain visible several weeks.

Waterspouts

are very frequent in tropical seas. Eddies of circular storm winds suck up into the clouds great draughts of water, at times hundreds of tons, which descend again in drenching rain. If they break over a passing ship, a frightful deluge follows. Sometimes three or four are seen at one time following rapidly the skirt of the storm.

Avalanches

are great fields of snow from the slopes of high mountains, such as the Alps, that suddenly slide down into the valleys, carrying rocks and ice with them, and burying all before them. No time is left for the villagers to escape; churches, houses, and forests are all swept away and buried.

Geysers

are vast fountains of boiling water, that in some volcanic countries leap fifty or sixty feet into the air, giving off immense clouds of steam. Some "blow," as it is called, at regular intervals; others are silent for a long time, and then are extremely active. Iceland has many of both kinds, so have New Zealand and the United States.

Marvelous is the scene from a balloon, above the clouds, especially when sometimes a rainbow-tinted shadow balloon shows itself. Marvelous are the great hailstones, and terrible is the havoc they sometimes make. Marvels are seen in the frost on a window-pane; and strangely beautiful are the patterns of a flake of snow under a magnifying glass.

The great book of nature is full of wonderful pictures, but it is also full of truth, order, beauty, and goodness.

TO THE RAINBOW.

Triumphal arch, that fill'st the sky,
When storms prepare to part,
I ask not proud philosophy
To teach me what thou art;

Still seem, as to my childhood's sight,
A midway station given
For happy spirits to alight,
Betwixt the earth and heaven.

Can all that optics teach unfold
Thy form to please me so,
As when I dreamed of gems and gold
Hid in thy radiant bow?

When science from creation's face
Enchantment's veil withdraws,
What lovely visions yield their place
To cold material laws!

And yet, fair bow, no fabling dreams,
But words of the Most High,
Have told why first thy robe of beams
Was woven in the sky.

When o'er the green undeluged earth
Heaven's covenant thou didst shine,
How came the world's gray fathers forth
To watch thy sacred sign!

And when its yellow lustre smiled
O'er mountains yet untrod,
Each mother held aloft her child
To bless the bow of God!

Methinks, thy jubilee to keep,
The first-made anthem rang,
On earth delivered from the deep,
And the first poet sang.

The earth to thee her incense yields,
The lark thy welcome sings.
When glittering in the freshened fields,
The snowy mushroom springs.

As fresh in yon horizon dark,
As young thy beauties seem,
As when the eagle from the ark
First sported in thy beam.

For, faithful to its sacred page,
Heaven still rebuilds thy span,
Nor lets the type grow pale with age
That first spoke peace to man.

—THOMAS CAMPBELL.

VAST DEPOSITS OF GOLD

Yukon District and Its Boundless Wealth—Mining Towns, Machinery and Modes of Transportation—Hardships of Gold Diggers.

GOLD was first discovered in paying quantities in the Yukon basin in 1881. In that year a party of four miners crossed the range and descended the Lewis river as far as the Big Salmon river, which they ascended for a distance of two hundred miles. Gold was found on all of its bars, many of which paid well. In the next three or four years some mining was done on the Pelly and Hootalinqua rivers, and, in 1886, gold in considerable quantities was found at Cassiar bar on the Stewart river. The richest, by the way, so far located in the Yukon country, yielded as high as one hundred dollars per day to each man.

As early as 1860 men in the employ of the Hudson's Bay Company are reported to have found gold in the Yukon basin. Professor Davidson credits George Holt as being the first white man to cross the coast range. A confusion exists as to the time of Holt's journey, the dates being variously given as 1872, 1874 and 1878.

Holt went down the chain of lakes to Lake Marsh or Mud lake, as it is sometimes called, and then followed an Indian trail to the Hootalinqua river, where, he reported upon his return, he had found coarse gold. No coarse gold, however, has since been found on that river, but the bars yield large quantities of flour gold. In 1880 Edward Bean led a party of twenty-five men from Sitka to the Hootalinqua river, but met with indifferent success.

The Yukon section may be divded into three divisions, namely, the upper lying entirely within British territory, and embracing the White, Stewart, Pelly, Lewis and Hootalinqua rivers, which together form the headwaters of the main Yukon, the middle division includes Fort Reliance and the country down to the mouth of the Tanana river; the lower division stretches from the mouth of the Tanana to Norton Sound and Bering sea.

Latest Discoveries.

It is in the middle division that the recent discoveries have been made; on Forty Mile, Sixty Mile, Miller, Glacier and Birch creek, and Koyukuk river. Forty Mile and Sixty Mile creeks flow into the Yukon from the west, having their source in the Ratzel mountains, a low, range running nearly parallel to the Yukon, and forming the divide between the Yukon and Tanana rivers.

The streams putting into the Tanana on the west side of this range have not yet been explored; but lower down, along the banks of the Tanana, gold in paying quantities has been found, and a few of the bars worked. Recent estimates of the gold output from the middle

division alone, for one year, are placed at $200,000; while from $25,000 to $50,000 have been mined in the upper and lower divisions.

Miller creek, one of the richest so far discovered in the interior, is a tributary of Sixty Mile creek, entering it about seventy miles from its mouth. It is about seven miles long, and upwards of fifty mining claims have been located there, but few of them have, as yet, been developed to any considerable extent. Miners prospected this creek at various times for several years, each time abandoning it because the vast accumulations of drift found everywhere made it unprofitable to work.

But, in 1892, prospecting again began, and many rich strikes were made. One claim alone yielding $37,000 of the yellow metal, and one clean-up of about eleven hundred ounces was reported. One hundred and twenty-five miners have located on this creek, many of whom own their own claims. The rate of wages here established is ten dollars per day, which is the usual price paid in all the camps.

THE WASH-UP: A SCENE ON MILLER CREEK, KLONDIKE.

The wash-up is accomplished by running water through a wooden trough. The water flows with such force as to separate the gravel from the gold, the latter sinking to the bottom.

Glacier creek is another branch of Sixty Mile creek being separated from Miller creek about three miles, and runs nearly parallel with it. Claims located on this creek and prospected last season, promise to equal in richness those of Miller creek, and rich finds have been reported here on claims abandoned by prospectors some time before. The gulch is nine miles in length, and varies in width

from a mile and one-half at its mouth to sixty feet at the head. The prospects on Glacier creek are even better than those on Miller creek, the dirt yielding from a few cents to four dollars to the pan.

Trip in Mid-Winter.

Mining Recorder Paddock, of Glacier creek, speaks as follows of a trip made in the dead of winter from Forty Mile post: "I started on January the third from Forty Mile for Miller creek, distant about sixty-five miles, and arrived February 27th. The cold was severe, the thermometer ranging from forty-two degrees to seventy-seven degrees below zero, compelling me to lie in camp for ten days. I drew a sled which carried my small outfit, and meeting many steep and difficult places on the route, across gulches and over ridges, I was compelled on several occasions to divide my load and take it in sections."

Another creek, distant about three miles from Miller creek, is named Bed Rock, but as yet has not proved very promising as a mining location.

Indian creek flows into the Yukon about thirty miles below Sixty Mile creek. Here rich gold discoveries were reported last year. The stream is rapid, but shallow, but prospectors have ascended it a distance of over one hundred miles.

Forty Mile creek is more familiarly known to the miners of Alaska, and perhaps to the people at large, than any other mining locality in the territory. Its bars have yielded large returns, but these diggings are practically abandoned for the gulches and ravines that furnish coarser gold. It is about two hundred miles long, and its tributaries are numerous. Entering the Yukon from the west, it drains the country lying between the Yukon and Tanana rivers.

It was not discovered until 1887, and was the scene of the first real excitement in the valley of the Yukon. This stream enters that river from the west in about sixty-four degrees north latitude and about one hundred and forty one degrees west longitude. Its mouth is in Canadian territory. The first news of gold being found here was brought to the coast by a man named Tom Williams, who was the bearer of letters to "Jack" McQuestion, of the Alaska Commercial Company's trading post at the junction of Forty Mile creek with the Yukon, who was then in San Francisco, advising him of the discovery, and instructing him to ship in a larger supply of provisions in anticipation of a rush to the new Eldorado the following spring.

Dog Team and Sled.

Williams was accompanied by an Indian boy with a dog team and sled. They had an extremely rough trip up the river. It was in the dead of winter and the cold was intense. Before reaching Lake Bennett the dogs all died from cold and exhaustion. At the summit of Chilkoot pass a fearful storm arose, and the struggling travelers were compelled to hastily build a snow hut in which they remained ten days, living on a little dry flour, the only thing left them in the way of provisions. Both men were badly frost-bitten, and upon attempting to resume the journey it was found that Williams was unable to travel.

Nothing daunted, the young Indian took his companion on his back and,

struggling through drifts and blinding snow, succeeded in reaching Ty-a, sixteen miles distant. A few days later Williams died, but not until he told Captain Healy of the strike at Forty Mile, and of his mail pouch containing his letters which was left at the snow hut at the summit, where it was afterward recovered.

Half a Million in Gold.

In the following spring active mining operations began, and, it is estimated, that since that time upwards of half a million dollars in gold have been taken out of Forty Mile creek, and the small feeders running into it. On Forty Mile nearly all the available rich ground has been worked out, but there are many high bars along the stream known to be rich, which have not as yet been touched, because of the difficulty of getting water through them, and the frozen condition of the ground.

Birch creek, the scene of the latest strikes and excitement in the Yukon country, runs parallel with the Yukon on the west, for over three hundred miles, and as elsewhere related, has a remarkable feature of a portage only six miles across between this and the Yukon, two hundred miles above its confluence with that stream, so a trip by water by one terminal of the portage to the other involves a journey of four hundred miles. Here on the Yukon side of the gateway to the Birch creek mines, is Circle City.

Ned Ayleward, a Birch creek miner, in describing the gold discoveries there says: "In coarse gold I got as high as thirteen dollars to the pan. The gold is like pumpkin seeds, but some pieces weigh from three to ten dollars, and I think I will make from forty to fifty dollars per day, when I have my claim opened up. In prospecting, I would get from fifteen to twenty dollars, under a little stone on bed rock. I did not leave Juneau broke, for in that case I would have had to rustle for a 'grub stake,' and in all probability would not have made this strike. I have seen no quartz claims here that amount to anything, but am on the look out for them."

Here are extensive auriferous deposits, and the creeks and bars adjacent to Birch creek have been more or less thoroughly prospected, with the result that this section bids fair to become a vigorous gold-producing rival of the famed Forty Mile district.

One of the principal tributaries to Birch creek is Crooked creek, and from Circle City a trail leads over the hills to the mines on Independence and Mastodon creeks.

Claims Staked Out.

On Molymute, a branch of Birch creek, gold was first discovered in 1893, and since that time it has been found on tributary streams. Birch creek has been explored for upwards of three hundred and fifty miles, and the entire distance is filled with rapids and canyons. The South Fork drains the country lying at the head of Seventy Mile creek. Many claims were staked off last year at Mastodon, Independence, and other streams flowing into Birch creek.

These claims are more easily worked than elsewhere on the Yukon and tributaries, from the fact that bedrock appears much nearer the surface, and water is

more easily obtained. Some sixty miles below Birch creek portage Preacher creek joins the main stream. This creek is about one hundred and twenty miles long. It has been prospected but little, and not much is known of it, except that as everywhere else in the Yukon basin, gold is found in greater or less abundance, and pays the miner well for his work.

Peculiar Country.

The headwaters of this creek penetrate a country whose geological formation is very peculiar, showing drift and disturbances which might have been caused by the receding of waters ages ago.

Three years ago some rich gold discoveries were made on the Koyukuk river which were prospected vigorously the following year with good results. A number of creeks, namely, North Fork, Wild creek, South Fork and Fish creek, have also been prospected with fairly good success, but no extensive deposits have yet been found.

Gold placer mining may be said to end here, as from this point to the mouth of the Yukon, little prospecting has been done. Below the Koyukuk river the only streams of any importance that empty into the Yukon, are the Innoko coming in from the south, and the Anvik from the north, about thirty miles further down.

Numerous creeks have been prospected and successfully worked along the branches of the Yukon and other rivers, some of them proving very rich; and during the past two years richer and more extensive deposits of gold have been found in this country, until to-day, the interior of Alaska is believed by many to be the largest placer mining district on this continent.

The difference in climate between the coast country and that of the interior is very marked. All along the Kuskoquim river, during the summer months, there is an excessive fall of rain, while in the interior it is very dry. Reference has also been made to the condition of the ground in the interior, and it is from the fact that the frozen earth extends to a depth of many feet below the surface, that placer mining in the interior is very difficult.

The surface of the ground is covered with moss often to the depth of eighteen inches, and the hot rays of the sun during the long days of summer are not able to penetrate sufficiently to thaw the ground underneath. It is only where the moss is stripped, and the bare surface is reached by the sun's rays, that it thaws to any extent.

Working the Sluices.

This method is often resorted to by the miners, in order to get the ground in readiness for their sluicing work. The ice does not usually pass out of the Yukon until the first or middle of June, but when it starts, it goes quickly, and miners are soon hard at work, digging into the bars and working their sluices.

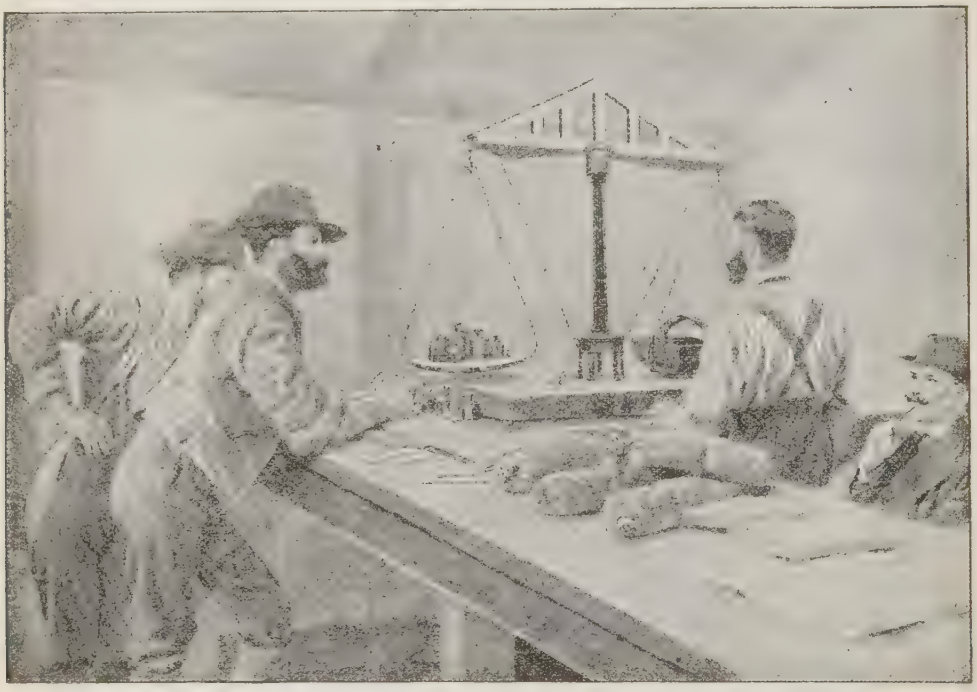
As early as the middle of September the sun becomes so low that the air is chilly, and in a few days ice forms, so that further working of the ground must be abandoned until the following year.

It must be remembered, however, that although one cannot depend upon much more than two months in which to work the ground, yet, from about the middle of June until the first of August, it is daylight,

and the sun shines almost continually. Thus, what is lost in the length of the season is, in a measure, made up in the length of the day; and, if a man can stand the severe physical strain he must undergo, he can put many more hours in here than in placer mining camps in other parts of the country; and if his claim proves sufficiently rich to enable him to pay for hired help, darkness never interferes with work, for by running two or three shifts each day, he can work his mine, and have daylight to do it in, nearly the entire season.

The complaint has always been made by miners, in the Yukon, and by those who know of the difficulties that beset prospectors in that country, that several months in the year are lost, and when the season closes nothing can be done but while away the time in visiting neighbors, making trips to the native settlements, or in hunting.

But the happy thought came to some one to spend some of the time in summer prospecting and finding favorable locations; and in the winter to make fires upon the surface, thus thawing the ground until bedrock was reached, then to drift and tunnel, lifting the dirt to the surface, and piling it up so that when spring came, and water was to be had, he could wash his dirt and make it profitable.



RESULT OF THE YEAR'S WASH-UP. WEIGHING THE GOLD AT DAWSON CITY, KLONDIKE.

The largest nugget ever found on the Yukon was taken out by one Conrad Dahl, and was found in Franklyn gulch on March 26, 1894. It weighed exactly thirty ounces before, and twenty-nine and

forty-five one hundreth ounces after being melted at the mint in San Francisco. Dahl had prospected in the vicinity the summer before, and in the winter thawed the ground by burning wood on top, and continued this process until he reached bedrock, hauled the dirt out, and washed it afterwards. The nugget brought four hundred and ninety-one dollars and forty-five cents.

Gold Quartz.

The next few years will probably determine whether there are any extensive deposits of gold quartz in the interior of Alaska. Most of the men who have gone into the interior have been men of very limited means, and the expense of carrying supplies in from the coast has been so great that their means was taxed to the utmost to land at the scene of their labors with food sufficient to last them a single season. It is thus seen that unless a "grub stake," at least, is made before winter sets in, they must go hungry or return to civilization. On this account they have not spent much time looking for quartz.

Companies have been formed and an effort made to test the quartz-bearing capacity of this country, with a very reasonable prospect that rich and valuable ledges will be found. It is fair to suppose when upon nearly every stream and creek gold is found in greater or less quantities, that somewhere in the mountains, whatever may be the climatic or other conditions that dissolve the ledges and turn the gold loose upon the broad level of the low lands, there must be rich gold quartz.

There are instances, and not a few, where men in prospecting or working placer mines, have come across boulders or rocks containing gold, but, for the reasons stated above, they were not able to expend the labor necessary to follow up the "float."

If the indications of the placer fields mean anything, they suggest that the interior of Alaska is, in a very few years, destined to become a great center of quartz mining.

Those who have not had personal experience in placer mining cannot realize the fascination which is always with one engaged in this occupation. It is a healthful, hopeful, rugged and independent life. The placer miner goes alone into the mountain fastnesses with pick, shovel and pan, far away from every scene of civilization. He feels a pride in picking out the yellow fragments, which he has separated from the dirt by dextrous dipping, gradually letting the gravel run out with the water, while the yellow deposits settle around the edge and gravitate to the bottom of the pan.

Ample Reward.

Before venturing upon the life, he is naturally overcome with dread of separation from home and friends. He realizes that he is to be deprived of the pleasures of society; perhaps he is leaving a loving wife and children behind, but when once in the field these recollections crowd him on to new life and spur him to renewed efforts. And when, perhaps, he has secured his treasure and returns to find that he has not been forgotten, life seems to open up through a vista of years a new and happy existence.

In no place on earth can you find such

loyalty to friends, such honor among men, as in the camp of the miner. They are the architects of their own laws, and executioners as well. Their lives develop all the characteristics that go to make up a strong nature, and the dangers with which they come in contact, school them to bear their burdens calmly and to meet peril, or death if need be, with fortitude and resignation.

IN SEARCH OF GOLD

Sailing Into the Wilds of Alaska to Find the Precious Metal—Many Thrilling Adventures and Hairbreadth Escapes.

THE following graphic account of his experiences by a gold seeker will be read with interest:

"We arrived in Juneau about the middle of June and at once repaired to one of the many hotels, which, by the way, are not at all bad for the rates, and at once began making inquiries about the route to the Yukon, etc. Our informants dampened the ardor of my companion from San Francisco with tales of such hardships and stories of the impossibility of making the trip so late in the year, that he decided to return to California, where walking was easier.

"This left me in a bad fix, as I had made up my mind to go to the Yukon and I hardly liked the prospect of going alone. However, I chanced to meet a couple of fellows in the hotel who were waiting for the 'Rustler' to transport them to Chilkoot inlet (she was laid up for repairs) and suggested that as there was small prospect of leaving Juneau for a week or two we might do well to purchase a craft of some kind and sail up to Dyea.

The idea was a feasible one and we at once set out for the boat market. After a great deal of dickering we finally persuaded a wrinkled old squaw-man to sell us his leaky punt for eight dollars; which we patched up with tomato cans and old rope, and gave the whole boat a liberal coating of tar.

"Early on the morning of June 27 we set sail for Dyea.

"Our stock of provisions and tools for building a boat on the lakes was a fairly complete one, and as we had the whole summer before us we kept well into the shore, (a map of the inlet cost us 50 cents), because of the senile state of our craft. A few hours out of Juneau landed us high and dry on a sand bar, the tides had gone out and we were stranded between the two channels. However, there was

nothing to do but to wait for the high tide, so we put in our time in spearing with a sharp pointed stick some of the millions of flounders that dart from under and around ones feet at every step taken in this shallow water.

"After making a hearty meal on flapjacks and flounder, we determined to sail or row all night, so lay cuddled up in the boat for a nap. After the returning tide again made a channel over the bar we hoisted our fly sheet and set sail under a good breeze towards the north.

"Nothing worth recounting happened during the first night of our journey. The morning approved to be a beautiful one with a fair wind, gentle enough to still any alarm we might feel for our loose-jointed 'yacht.' So we kept our boat headed towards our goal. The evening of the third day of our voyage proved to be too stormy for us to continue it, so we went ashore and hauled our boat well up the beach, and began looking around for a good place to pitch our tent, which we had improvised out of a fly-sheet.

"The spot we had selected was just within the fringe of woods that came down the gently sloping mountains to within a hundred yards of the water's edge; we built a fire and went down to the rocky beach to collect some of the mussels that almost hid the rocks, so numerous were they. It was just getting dusk and one of my companions, a Swede, a very fidgety beggar, ever on the lookout for trouble, asserted that he saw a bear coming along the beach about half a mile from our camp, a hasty scramble back to the tent for our arsenal, which consisted of a Winchester, an old fashioned muzzle-loading fowling-piece and a four-pound axe.

INDIAN MEDICINE MEN STILLING THE WAVES.

"The Swede already had a revolver in his belt, so we made ready to do battle with the shaggy beast the Swede had seen. After two hours waiting in a defensive attitude we decided to make a sortie. It was by this time quite dark, but the fire on which we had piled a number of well dried logs was burning brightly and threw a fitful glare over the beach in our immediate proximity, making deep shadows on the dark side of the rocks.

"About three hundred yards from where we stood we saw a great black object moving about near the water's edge and we were in that high state of nervous excitement which is born only of a mixture of fear and bravery. Seizing the rifle one of my companions commenced a fusilade in the direction of the now approaching object, none of the bullets seeming to take effect as it got nearer and nearer, and we were now certain it was a bear of huge dimensions.

Terrific Growls.

"The last ball from the rifle evidently wounded the beast for it dropped suddenly on its haunches and gave vent to a series of ominous growls. Waiting until we thought there was no danger in approaching within reach of it, I at once emptied the contents of the hastily snatched Swede's revolver at the crouching form of the bear, which was lying behind a log that had been cast on the beach by the waves.

"That the beast was badly wounded there was no doubt because although growling constantly he was unable to rise. Running to where my companions were I seized the axe and back I went to the one-sided conflict. Aiming a vicious blow at the snarling visage of the animal I brought the axe down with might and main and buried it deep in the log.

"I precipitately fled and only the jeers of my well-armed comrades goaded me to go back for the axe. I wrenched it loose from the log and brought it broadside in contact with the head of the now whining beast and the battle was over. Victory was mine and I had slain a miserable cub bear about as big as an ordinary cat. We spent the rest of the night in comparative quiet and the following morning set sail for Haine's Mission, which was perhaps 15 miles from our last camp.

A Sudden Squall.

"Nothing occurred worth relating until within sight of the mission, when a sudden squall (very common in this inlet) blew us onto a sand bar. We had a terrible time in getting our boat again headed for the mission, but after many narrow escapes, succeeded in getting within a mile of the village before the fury of the storm which followed the squall burst upon us, and of all the miserable journeys we had on our whole trip, that mile was the worst.

"We finally reached the rocks skirting the bay just as our boat filled with water, and were pulled out more dead than alive by the friendly natives. The Cure in charge of the mission tendered us a cordial welcome, and, having dried our clothing, we went back to the scene of the disaster, and there, fifty feet from the waters' edge, lay our old tug, still containing the heavier articles of our outfit. The remainder, clothing, oars, sail, etc., was strewn all along the beach.

"Nothing daunted, we patched up the seams of our craft and again set sail for Dyea, about fifteen miles away. We were uninvited guests of the mission for nearly a week, but our welcome was a hearty one.

"Reaching Dyea after a few hours' sailing and rowing, we found ourselves at a loss for Indians to pack our goods over the Divide. This was before the rushes into the Yukon. The storekeeper at this place informed us that the Indians had all gone salmon fishing, and advised us as to the best means of towing our tottering old boat up the river to the head of canoe navigation.

Good-bye to Civilization.

"We left Dyea on July the 10th, having been nearly two weeks coming from Juneau. We could have made the trip on the 'Rustler' in less than twenty-four hours.

"Bidding good-bye to civilization and all hope for aid in emergency, we commenced our journey up the short but rapid Dyea; a mile or two above the store, an old Indian coming down the river in his dug-out stopped to converse with us, and, after persuading him to tow us up the river for the 'bear-skin' and the boat, we transferred our kit to his dug-out and resumed our journey, and in a few hours made camp at the head of canoe navigation.

"Here we became neighbors of a camp of squaws who had accompanied a party of Indians to the lakes, and were returning to their homes at Dyea. Their faces were blackened with charcoal, and they presented a very curious appearance. Whether they acquired this habit from observing their white sisters using 'Pozzoni' or not, I cannot say. I was afterwards told by an old Indian trader that charcoal applied to the face was better than goggles for preventing snow-blindness.

"The following morning we began our fearful journey over the Divide. Having to pack our own outfit, we had to make two trips, carrying 100 pounds for a mile or two, and returning for the balance. After a terrific day's work, we got all our goods to Sheep Camp and dreamt of Home, Sweet Home. The following evening saw us at Stone House, after a day's hard climbing over rocks and fallen tree trunks, differing only in point of labor from the preceding day.

"We were delayed at this camp for three days on account of the severe storm that was raging. It rained in torrents and the wind blew so hard that we decided to stay in our present uncomfortable quarters until it abated somewhat.

"It is very dangerous to attempt to cross the Divide in a storm, and as we had been warned about crossing in bad weather we had to make the best of it.

Drenched by the Rain.

"Of course our fly-sheet did us some service at this camp, but we were most of the time thoroughly drenched by the rain that poured down from the angry clouds that scudded over our heads. At length, however, the sun peeped through the clouds and the storm was over. Stone House is, indeed, a desolate spot. Straight ahead of us the field gradually slopes up towards the summit, which we could not see but could feel, and its touch made our flesh crawl.

"It does strike awe into a man's soul to

be comparatively alone in this wilderness of silence that is rarely broken save by the rippling of the little cascades that tumble down the perpendicular sides of the mountains or the boom of the ice dropping from the glaciers that are the crowning glory of the cliffs that form the sides of the ravine up which we are traveling. The unmeasured tread of the army of prospectors who annually walk wearily, painfully over the snowy carpet that leads to the crest of the ridge is unheard save by themselves.

"At last we arrived at the last stage of our climb, and we took a survey of the almost perpendicular snow cliff over which we had to go. There was no way out of it, so up we went, following the advice and gradually crawling over to the right side of the ascent, where there was a quantity of slide-rock which gave us a very fair foothold and enabled us to get over the ridge without any mishap.

"Part of outfit had been left at the last bench, so we emulated the example of the Indian's method of going down a snow bank. About three minutes sufficed for us to get to the bottom of this giant toboggan and we were about three hours in again returning to our packs. From here down to Crater Lake we found very little difficulty in transporting our goods; in fact, the greater part of the journey we made by sitting on our packs and sliding down.

"We followed the course of a little stream running out of this lake, and about eleven o'clock the same night camped in the woods about seven miles from the summit.

"Early the following morning we conveyed our baggage to the head of Lake

INDIAN VILLAGE, NULATO, ALASKA.

Lindermann, and after making camp we determined to spend the balance of the day in resting, for we were thoroughly fagged out.

"The distance from the summit to this lake is about ten miles. The day after our arrival at Lake Lindermann we looked over our outfit preparatory to starting work on our boat and discovered that somewhere along the trail we had left our whip-saw. Here was a dilemma. We could not go back after it; that was out of the question; we might search for a week and not find it, and we could not make a boat without it, so the only way out of the difficulty was to build a raft and do the best we could with that.

Prospectors Discouraged.

"When our raft was nearly completed, two returning prospectors stumbled onto our camp, and informed us that they left a first-class boat on lake Bennett and if we could get there before any natives destroyed it for the nails, we were welcome to it and all the provisions they had cached. They had started for Forty Mile, and at the foot of Mud Lake had become discouraged, and were on their way back to Juneau. They had had enough of the Yukon even before they reached there.

"We pulled straws who should go and secure the boat, and the lot fell to me. I was always an unlucky fellow.

"I left my companions to finish the raft, and taking my rifle and a few flap-jacks with me I lost no time in pulling out for that most necessary means of conveyance —a boat—and I believe I prayed all the way to its hiding-place that nobody had taken it.

"Eventually, by following the shore of Lake Lindermann, after crossing several waist-deep streams, I reached the portage leading to Lake Bennett. It did not take me long to trot up the trail and get a glimpse of the lake, as the portage is only about half or three-quarters of a mile long, and I soon found the boat, for which I felt very grateful.

Dreams of Gold.

"I was tired out with my journey, so went to sleep in the boat and dreamt of gold and grub for about ten hours. Upon awakening my first thought was to look for the cache the men had told us about and easily found it, although it was ingeniously hidden underneath a pile of rocks. The outfit was a good one and considerably strengthened the one we had brought with us.

"I shot a few squirrels and spent the time trying to catch a few fish while waiting for my companions to bring our own outfit down on the raft. It took them three days to complete the raft and one day to run the lake, so you can imagine that I was very glad to hear a shot one morning, which was the signal agreed upon to let me know that they were at the portage. We soon carried the oufit from the raft to the boat and lost no time in setting sail for a better camping place than I had. We had an uneventful journey down as far as Lake Takou.

"We were caught in a storm on this lake and forced to run for the shore and were laid up here for eight days. It was during this delay that I had my first taste of porcupine, and I must say that the flesh of this unsavory looking beast is first-class—not much unlike roast sucking-pig.

We baked it after the fashion of the country, by digging a hole in the ground and covering the carcass with leaves and mud and depositing it in the hole, prior to building a fire over it.

"It is a queer way to do one's cooking, but after all we are in a country where the niceties of the dinner table are not very much in vogue, and I will say that we enjoyed that meal better than any we had partaken of for nearly a month. After the storm on the lakes nothing befell us nor anything happened, worthy of note, until we reached Miles canyon.

A Rush Through the Canyon.

"Here my companions insisted on running through the canyon, which, to say the least, is rather ticklish, and I objected very strenuously, deeming it wise not to expose ourselves to any danger avoidable. The portage there is easily made and not more than half a mile long. However, after putting ashore a portion of our outfit, we pulled out into the centre of the stream and in a moment were flying through the canyon on the crest of water that recedes on either side to the perpendicular cliffs that form the side of the canyon.

"Pulling at the oars with all our strength, steered by the fellow in the stern of our boat, we manage to keep on the comb of the water, and before we could see the danger we were passing we shot out of the canyon into a smooth eddy on the right side of the river and our mad race was run. It is very exciting and inclines one to want to repeat it, but it is a stupid thing to do.

"About three miles below the canyon we came to White Horse Rapids, which we did not attempt to run. No other incident happened until after we had passed Five Finger Rapids when, a few miles below them we saw a fine specimen of moose swimming the river, and after using nearly every cartridge we had in stock we succeeded in killing him, and what to do with the carcass we did not know.

"However, we towed the big beast ashore and dressed it as well as possible, cutting off the choice joints for home consumption. We made many a hearty meal off the delicious meat, never for a moment longing for the tough roasts we had left so far behind us. It is impossible to describe the peculiar flavor of this best of all venison.

"A journey of four or five days brought us to the present site of the famous Klondike river. We did not know when we camped on the present site city of Dawson City, that we were lying on a bed of gold and had we even suspected it, I do not think the tempting bait of Forty-mile would have induced us to go there.

"Heigho! we were soon at Forty-mile, and the journey was practically over. My subsequent hopes and disappointments were many, and, although I did not strike it extremely rich, still I am not sorry I went to the Yukon. The history of the various mining camps is too well known to need repetition, and I will close my little volume by stating that my last winter in the Arctic was spent in traveling over much of the unknown country lying to the east of Port Clarence and south of Point Barron, with Bishop Tosi, the prefect apostolic of Alaska, and that jolliest and best of all Alaska missionaries, dear old Father Barnum."

SINGLE SCREW STEAMER

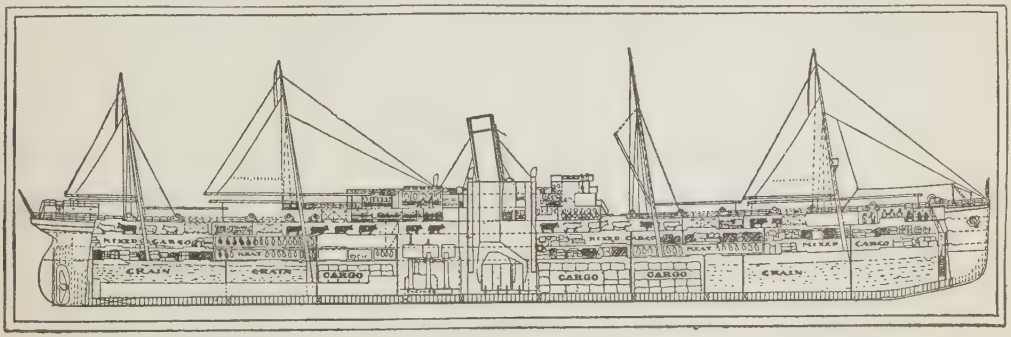
Immense Carrying Capacity of the Largest in the World.
A Wonderful Floating City.

THE steamship "Devonian" has been specially constructed for the Leyland Line to run in their Liverpool-Boston passenger and cargo service. She is the largest single-screw steamer in the world. having a displacement of upward of 21,000 tons, with a length of about 575 feet over all. This line is a believer in single screws, and the sister ship "Winifredian" was successfully employed as a government transport for two trips to the Cape.

The vessel is built of steel to Lloyd's highest class, under special survey, and arranged on the cellular double-bottom system, having in addition two deep ballast tanks (water) placed one at each end of machinery space. The water ballast capacity is 4,384 tons. There are ten watertight bulkheads carried up to the upper deck. The upper deck is arranged to convey 850 head of cattle, also accommodation for horses, sufficient drinking water being carried for them in the double bottom.

The bridge deck includes the saloon, which has seating accommodation for over 100 passengers. The promenade deck contains the remainder of the state-rooms, with music rooms and library and smoking rooms. The shelter deck extends the full length of the passenger accommodation. Accommodation is provided for 135 first-class passengers.

The main engines are of the triple-expansion type, direct acting and surface condensing, with indicated horse-power of 5500. The propeller has four blades of manganese bronze. The air pump is driven by levers from low pressure engine; the circulating pump is of the centrifugal type, driven by two engines, one of which is quite capable of doing the work. Steam



WHAT THE STEAMER "DEVONIAN" CAN HOLD. CROSS-SECTION OF THE GREAT SHIP.

is supplied at a pressure of 200 pounds by four steel boilers which have eighteen furnaces. The funnel is double and is 103 feet from the level of low furnaces. A refrigerating installation is fitted in tunnel for the ships' provisions. The bunkers hold about 2,000 tons of coal.

The steamer is an immense carrier, carrying upwards of 20,000 tons measurement cargo. The general workmanship will be appreciated from the fact that the steamer was built by the well known Belfast firm of Harland & Wolff, whose first ship was built about 1860 for the Leyland Line. The steamer's immense size and power, which drives her at the rate of fourteen to fifteen knots per hour, will also be appreciated by the fact that he could steam round the world without recoaling, besides carrying 800 horses, 1,000 troops, and some 2,000 tons of guns or stores.

LARGEST DINNER

King Edward VII Gave 600,000 Poor People of London a Coronation Treat.

ABOUT one-tenth of the population of metropolitan London enjoyed the King's hospitality and at least 80,000 attendants waited upon them at 800 feasts in twenty-nine boroughs. Statistics of this unexampled bounty to London poor might be extened to mileage of tables, tonnage of provisions consumed and many other details, but the spirit of loyalty and affection of the masses for their sovereign could not be summed up in cold figures nor could the perfection of the organization with which the general scheme of entertainment had been worked out be disclosed in this way.

Every onlooker of these dinners was impressed with the heartiness with which the King's health was drunk, his special message received and the national anthem was sung. The King, in consequence of his illness, commanded, without a doubt, the sympathy of the masses to an exceptional degree.

The largest company of diners in any one place was Fulham, where the Bishop of London said grace and the Prince and Princess of Wales were spectators. The greatest number under a single roof was 10,500 at the factory of the London General Omnibus Companies where Princess Christian was warmly received. Thirteen members of the royal family were indefatigable in visiting as many dining places as possible.

The same general order was followed at the 800 dinners. There were two courses, one with a choice of four or five kinds of meat and vegetables and plum-pudding for a sweet, and ale, beer, cider and ginger ale were served, and every guest had a quarter of a pound of chocolate and a souvenir coronation mug.

Thousands of well-to-do women waited upon them, and 1800 musicians, singers, reciters and other artists entertained them. To every man was presented a package of cigarettes and another of tobacco, but there was little smoking.

Many Entertainments.

There were prolonged entertainments at more than half the dinners, Arthur Roberts leading the way at the Great Hall of the Law Courts and the grounds of London Hospital, and nearly all the concert singers and music hall artists of London offering their professional services. Most of the professional performers had the good taste to appear handsomely dressed, as though they were entertaining West End drawing-rooms instead of the poorest people of London.

One of the most interesting scenes was the dinner for the blind, at Bury Street Mission Hall, under the special patronage of the King and some of the most fashionable people of Belgravia. A large company of blind was collected from many districts, and after the dinner there was a merry hour, in which the sufferers forgot the pathos of their lot. Mrs. Percy Donovan sang for them. Mrs. Martha Gielow, of New York, gave a series of Alabama plantation entertainments, and there were comic recitations by Rev. Herbert Marston, a blind preacher, and H. L. Meares, a clergyman who was nearly blind.

The entertainments provided for the King's 600,000 guests were enjoyed even more heartily than the excellent dinners, and masses and classes were brought into sympathetic touch at the close of the interrupted coronation festivities.

The King's feast to the London poor was a highly successful affair. It was something more than merely supplying a few thousand starving wretches with food and drink for one day, which, rightly viewed, would have been merely an aggravation of their misery; it was the King's official recognition of the lower classes of his subjects. It was its moral effect, not its physical effect, that gave the event its value. The recipients of the royal bounty were by no means all poor and wretched; many of them were well dressed and comfortable looking, and one of these is quoted as putting his presence and that of others like him on the ground that the King's invitation included them, and they were his guests just as much as were those who dined with him at Buckingham Palace.

All Loyal Subjects.

It does not seem to have occurred to the speaker that this line of argument placed him and those of his class on a level with the paupers of London; but that is a point of no interest to the world at large. The real significance of the feast was its assurance to the meanest of King Edward's subjects that they are also his people—and the assurance was made more emphatic by his solicitude, when suffering in body and spirit from his affliction, that, whatever else of the coronation ceremonies might be foreborne, the dinner to the poor must on no account be omitted.

Thus the great army of London poor were made to feel that they were not forgotten, and were invited to a share in the royal pageant. This was one feature of the coronation that was not postponed by the King's illness.

THE GAME OF POLO

How the Sport is Conducted—Trained Horses and Expert Riders—A Fashionable Pastime.

POLO is an equestrian game which may be briefly described as hockey on horseback. It is of oriental origin and of high antiquity; indeed it has been claimed that it can be traced back to 600 B. C. Polo was first played by Europeans in 1863 in Calcutta, whither it had been brought by officers who had been stationed in Cachar in Assam, where polo had been played since time immemorial by the hill-tribe of Manipuris. Almost the same game exists in Thibet; whilst native equestrian games more or less closely resembling polo are played in Japan and other parts of the East. Since 1871 many polo clubs have been started in Britain, and, since 1876, in America, as well as wherever Britons are found in the East. The principal British club, which makes the rules of the game, is at Hurlingham, near London.

The following is a short description of polo: An oblong space of turf is marked out, of which the proper size is 300 yards by 200 yards; at each end in the centre of the line two poles are fixed 22 feet apart, forming the goals through which it is the object of opposing sides to strike

A POLO PONY TANDEM RACE.

the ball. The players are mounted on ponies, the size of which, according to rules, should not exceed 14 hands; and each player is armed with a polo-stick, consisting of a strong cane about 4 feet long with a cross head about 8 inches long with which to strike the ball of light wood.

The proper number of players is four a side, each of whom has a definite place (numberd one, two, three, and back) in relation to friends and opponents; and in polo as in most games, combination is perhaps the first condition of success. The ponies have to be carefully trained, and some acquire wonderful cleverness in understanding what is required of them. It is part of the game so to ride alongside an opponent as to prevent him from hitting the ball, but it is not allowed to ride across in front of an opponent. To become a good player requires strength, good horsemanship, a quick eye and much patience.

Our illustration pictures a spirited race with horses arranged in tandem fashion, for the purpose of ascertaining what team is capable of the greatest speed. The animals are so thoroughly taught that they will obey every direction given by the driver either by voice or with the reins. The team that reaches the goal first and conducts itself in the best manner receives the first prize.

There are polo grounds in the vicinity of New York where many men belonging to the "four hundred" display their skill Matches are sometimes formed which awaken great interest and draw crowds of spectators.

CULTURE OF SILK

How One of the Finest Fabrics is Produced.
Extent of the Silk Industry.

THROUGH the efforts of Philadelphians it is probable that within a few years this country will rival France in the culture of silk. Secretary Wilson of the Department of Agriculture, announced that climatic and other conditions in the vicinity of Philadelphia are admirably adapted to the raising of silkworms. The practical investigation by the Department of Agriculture of the whole subject of silk culture dated from the Centennial of 1876.

Officials who have been looking into the matter declare that the $45,000,000 worth of raw silk imported by the United States in one year might just as well have been produced in this country, and it was consequently determined to ask larger Congressional appropriations for the purpose of experimenting in this very important infant industry.

General interest in the enterprise was aroused in the years between 1880 and 1890 very largely through the instrumentality of the Ladies' Silk Growing Association of Philadelphia. Through

the efforts of these women a great deal of raw silk was produced, but they were obliged to abandon the fruitful "missionary work" soon after 1890 owing to unfair tariff discrimination against native raw silk.

Source of Vast Wealth.

Silk culture is not, and never has been, an exceedingly remunerative business, but it adds vast wealth to the nations engaged in it for the simple reason that it may be carried on by persons practically without capital. Thus this new vocation holds out alluring promises to hundreds of thousands of families in the United States who would be glad to make an addition to their annul income by giving light and easy employment for a few months each year to the more aged or the younger members, or even to the women of the family who might otherwise have no means of using their time profitably.

The class to which silk culture will offer the greatest boon will be the housewives. In many instances the mistress of a home has domestic duties which preclude the possibility of her following any ordinary vocation, and yet she has each day some leisure which she would be glad to devote to any occupation which would add to her personal funds.

The raising of a few pounds of cocoons each year will not materially interfere with the household and other duties of the women and girls in the home, and it is by each household raising a few pounds of cocoons that silk culture must be carried on, as it always has been in other countries. In France, for instance, cocoons are regulary produced by more than 150,000 families.

There are people in Utah at the present time who are raising silkworms from year to year, growing mulberry leaves for their food and actually producing silk and weaving it into clothes for family use. It is proposed that the government employ some of these experienced persons to instruct those who wish to take up the industry in the East and South. The new industry, by the way, holds out special possibilities for the people of the Southern States, where labor is cheap.

There are two species of mulberry native to the United States, the red and "small-leaved," but neither is suitable as food for silkworms. However, the foreign varieties grow well here, and better still, the leaves of the Osage orange, so plentiful in many parts of the country, have been found to be quite as good food for silkworms as the time-honored mulberry leaves.

Worm that Spins Silk.

The silkworm is the larva of a moth, of which there are several species. Each spins silk of a different quality, but none of it is characterized by such strength and fineness as the variety which has now been under cultivation for centuries. The greatest efforts have been made to improve the silk-producing qualities of the insect by selecting the most capable specimens from generation to generation.

Various peculiarities, appearing accidentally, have been perpetuated by breeding. In consequence there are now as many species of the silkworm as of the dog. Indeed, the silkworm has become a domesticated animal and has lost the power of flight (when in the moth stage showing no desire to escape from confine

ment as long as it is kept supplied with mulberry leaves.

Silkworm eggs are nearly spherical and about the size of turnip seeds. Each female produces from three hundred to four hundred eggs, but it requires fully twenty thousand of the eggs to amount to an ounce in weight. When, after a signal has been given in the form of a slight, clicking sound, the infant worm gnaws its way out it proceeds to develop a wonderful appetite, consuming its own weight of leaves every day while growing.

When the insect has attained its full growth it becomes restless, stops feeding and throws out silken threads. This silk is formed in a fluid condition and issues from the body of the worm in a glutinous state—apparently in a single thread. Out of this silk the animal constructs its cocoon, consuming an interval of from three to five days in the work, and then shuts itself up in the dainty box from which, in the natural course of events, it would in due time emerge as a moth.

Were the moth allowed, after having passed through the chrysalis stage, to accomplish the transformation, and come out of its fragile prison in its own fashion, it would break many of the silken threads. And thus as a precautionary measure the grower takes time by the forelock and steams the cocoons until the insects are dead.

REELING SILK FROM COCOONS IN JAPAN.

The silk is then unwound from the cocoon. The outer silk, known as "floss," is used for carding, being loose of texture, but the inner cocoon is tough, strong, compact and composed of a continuous

thread, which is not wound in concentric circles, but in short figure eight loops.

Providing a proper home for silkworms is by no means a difficult task. The room in which they are reared should be well ventilated and warm in winter. If only a few insects are reared the entire operation may be carried on in trays on tables, but where the work is conducted on a more extensive scale it is advisable to provide an arrangement of deep shelves, ranging one above the other from the floor to the ceiling of the room, and upon these the eggs when about to hatch are spread and covered with ordinary mosquito netting and a few finely cut leaves. The new-born worms can be depended upon to creep through the meshes of the net in search of food and can then be removed to any place desired.

Brought by First Settlers.

Silkworms were brought to Carolina and Georgia by the first settlers, and the industry quickly took root. In the year 1795 more than $75,000 worth of raw silk was exported from the port of Savannah alone. The Revolutionary War caused the industry in America to wane, but at the close of the conflict Benjamin Franklin and other patriots took active measures to revive it.

The State of Connecticut offered a bounty to silk growers, and up to 1830 that State produced more silk than any other in the Union, the output exceeding in value $200,000 a year. In the winter of 1844, however, a severe frost destroyed hundreds of thousands of the imported Chinese mulberry trees, many of which had been purchased at prices ranging from $2 to $4 each, and silk-growing in the United States received a set-back from which it has never recovered.

Done by Hand Power.

In China and Japan most of the silk is unwound by hand power. Excellent silk may be made with careful management by a good hand reel. The persons employed in unwinding silk are mostly women, one standing or sitting before each basin, of which she has entire charge. The basin is made of copper and the water is heated to near the boiling point. The cocoons are then plunged into it, and moved about so that the gum which fastens the threads may become uniformly and thoroughly softened. They are then beaten with a small birchen broom, having the tips split so that the loose threads readily fasten to them.

After beating a short time the operator gets all the cocoons fastened, and taking a bundle of threads shakes the cocoons until each hangs by a single thread. She now takes up five or more threads, according to the quality of silk wanted, unites them and passes them through an eyelet or guide. A second strand is made in the same way. These two strands are then brought together, twisted several times, separated above the twist, and passed through a ringlet, by which they are led to the reel. Instead of the two strands being twisted around each other, each strand may be so arranged that it can be wound around itself. A careful examination of the picture will explain the latter method. The strand being in the right hand of the operator passes through an eyelet on the cross-piece just above the basin, whence it is

carried to the ring on the short cross-piece near the top of the frame.

From here it is brought down to the second cross-piece above the basin. After being twisted about the ascending strand, it is taken to the eyelet on the long cross-piece at the top of the frame and then to the reel. The object of the crossing is to round smooth and condense the separate threads into one compact strand. Uniformity of thread depends upon the skill of the operator. When the water is too hot the silk rises in lumps, when too cold it unwinds with difficulty. The operator is supplied with a skimmer to remove all refuse matter from the basin.

"Raw" Silk.

Before the skeins which come from the reel are ready for the manufacturer they must be cleansed. The fibre is finally run on reels of a large diameter and taken off and twisted into a peculiar knot or hank. This is known as raw silk, and is shipped in large quantities from China and Japan to the United States and European countries.

In Japan a large amount of the silk is kept at home and used in domestic manufactures. The growth of the manufacture of native silk has steadily increased until the value of the product amounts to nearly $5,000,000, and is largely exported to the United States and other countries.

The Japanese raw silk is used in Europe more frequently for the woof than the warp, the lack of uniformity in the yarn proving a serious detriment in the manufacture of fine silks. In the United States, where a large quantity of silk manufactured is of low grades, the superior Japanese silk is used for the warp and the inferior for the woof.

The process of reeling is clearly illustrated by the picture—the basin containing the cocoons immersed in the water, the crossing of the strands, and their guidance through eyelets to the reel. The power is furnished by the pressure of the operator's foot upon the pedal, worked in a manner similar to the sewing machine.

Dyeing and Printing.

The dyeing and printing of silks in the piece is a branch in which remarkable improvements have been made by the domestic piece dyers and printers, a number of extensive and thoroughly equipped establishments being devoted to this class of work in Paterson, N. J., and elsewhere. The materials are usually pongees and various unbleached, or "ecru," silks "in the gum," taffetas, foulards, and other weaves.

In former years the chief imported stuffs that were to be printed were treated almost exclusively by Lyons printers, who excel greatly in the art, but for some years past the domestic printers, who impart anywhere from one to seven, or even more, colors, and understand the art of "fixing" them, are doing about all the work for the American market, and are turning out some rarely beautiful goods, the figures being engraved on copper rolls, or cylinders, whence they are removed when the pattern is no longer wanted and others are substituted.

Printing upon the warp before weaving is an important feature of the business, and our print works are turning out some exquisite work of this character.

TRUSTS

Immense Combinations of Capital Employed in Many Industries. Benefits and Evil Results.

TRUSTS are entirely of modern growth and are in their infancy, the very use of the word, in its present meaning, having arisen since 1885. A brief exposition of trusts falls naturally under four heads: Their nature and how they are formed; their economic effects; their legality; and their probable future.

THEIR NATURE AND HOW THEY ARE FORMED.—A trust is at bottom a combination of two or more competing organizations under one management for the implied or expressed purpose of regulating the amount of production and increasing the profits of the combining concerns. In the words of a learned jurist: "The purpose of a trust is to make larger profits by decreasing costs, limiting production, and increasing the price to the consumer. This it accomplishes by presenting to competitors the alternative of joining the trust or being crushed out. Its organization is intricate, secrete and subtle. It is a masterpiece of modern ingenuity and fertily of resource. It is the product of the highest order of business talent and executive ability. It is at once a monument to American genius and a symbol of American rapacity."

Others, however, view the trust as the natural outgrowth of modern competition in manufactures and trade. Just as the products of the small factory drove the hand-loom weaver out of the market, and later on, when the manufacturers began to combine into corporations, their products drove the small factory to the wall, so now by the use of the improved facilities, the trust is beginning to undermine the corporation.

The opponents of the trust argue that they are rank excrescences, begotten by modern competition in its mad rush for riches; while their defenders insist that they are the natural outgrowth of the modern industrial system. There are various methods of organizing a trust; sometimes each of the combining parties leases his concern to one central body, which at once places all the stock in the hands of trustees, who, in their turn, issue trust certificates to the various combining parties, as their several interests may appear.

Another method is to have one central corporation purchase, as fast as they are manufactured, all the products of the various parties. A fixed price is placed on the aggregate production of each party. Then, trustees are elected who control the sale of the whole product and divide the proceeds proportionally among the various parties of the transaction. But the usual method is that of incorporation. Each party gets his "concern"

incorporated. Then the several corporations turn over their stock to trustees; and from these trustees, each party receives trust certificates which are similar to shares of stock in the corporations.

The trustees, being thus vested with supreme control, can open and close establishments, limit production or increase it, consolidate at any given point, elect directors; in short, control the market. No establishment thus shut up can complain since it gets its profits from the whole trust, and not from a part of it.

Great Monopolies.

THEIR ECONOMIC EFFECTS.—Public opinion can not be said to have become settled as to whether the economic effects of trusts are good or bad. It is claimed on one hand that trusts tend to build up monopolies, to destroy competition, to create, by high prices, immense private fortunes, at the expense of the public weal, and even to undermine the neutrality of legislation. In support of this claim are cited monopolies like the Standard Oil Trust, the American Cotton-Oil Trust, the Anthracite Coal Corporation of Pennsylvania, which latter comprises six railways and owns 195,000 acres of anthracite coal land out of a total of 270,000 acres.

On the other hand, it is claimed that an exclusive power to produce a commodity, derived from the ability to make said product more cheaply than others, because of enormous capital and superior methods, is a gain to the public. As to destroying competition, the advocates of trusts hold the reverse to be true, on the ground that the larger the business the smaller need be the profits, and, as the profits are lessened, the intensity of competition is increased.

It is admitted that trusts create large private fortunes, but denied that they tend to raise prices. For instance, since the Standard Oil Trust was formed, in 1871, oil has been taken directly from the wells to the market by general pipe lines. There are now such lines extending to New York, with the capacity of 25,000 or more barrels per day. Another line goes to Philadelphia, one to Baltimore, one to Buffalo, one to Cleveland, one to Pittsburg and one to Chicago.

In this way the trust has saved 66⅔ per cent. on transportation. In 1872 it cost $1.50 to send a barrel of oil to New York; now it costs 50 cents. In 1872 barrels cost $2.35 each; to-day the Standard Oil Trust makes barrels for $1.25, saving here $4,000,000 per year. Tin cans are also made 50 per cent. cheaper, thus saving $4,500,000 annually. So likewise of wooden cases, made in 1874 for 20 cents each, but now for 13 cents each; and $1,2500,000 is annually saved in this way.

How Legislation is Affected.

As to the influence of trusts in undermining legislation, claims are made on both sides. The anti-trust party claims that trusts have filled the corridors of state legislatures with lobbyists sent to corrupt members and bring them over with golden arguments to work for trusts. The trust men, on the other hand, complain that the statute books are loaded with new legislation against the forming and carrying out of trust organizations. In spite of these contesting claims, the impartial thinker will find little difficulty

in seeing where the trust lies. It is an old axiom that "Where combination is possible, competion is impossible." Society in the majority of instances is vastly better off with many small fortunes among its members than with a few large ones.

Increase of Large Establishments.

Trusts inevitably drive all small concerns to the wall, and build up a few large establishments on their ruins. It is not for the well being of society that for every rich man so created, there should spring up one hundred poor men. Within a few years sixteen of the large sugar refineries in the United States, furnishing the bulk of all the sugar consumed, joined in a trust with a capital of $50,000,000. As soon as the combination was effected, five of these sugar refineries shut down and refused to produce. One, the North River Refinery, in New York, was sold for a ity park; another has been dismantled. At once the margin between raw and refined sugar began to widen. At one time it reached one cent a pound.

The yearly consumption of sugar in this country is 3,000,000,000 pounds. One cent a pound above ordinary profits means $30,000,000. The effect of such combinations is obvious. To the producers of the raw material they dictate prices, for there is but one purchaser. To the consumers of what they sell, they dictate prices, for there is but one seller. Are such fortunes, made at the expense of thousands of laborers and thousands of small manufacturers, in accordance with sound public policy? Are such combinations, making competition impossible, good omens for our industrial prosperity?

THEIR LEGALITY.—Are trusts legal? Professor Theodore W. Dwight, of the Columbia Law School, in an elaborate article, holds that they are. He carefully examines the ancient common law upon the restraint of trade; he finds the law to be that freedom of trade must in nowise be restrained; he argues that the legal right of individuals to produce severally includes their right to produce collectively, as an associate body or trust.

He concludes this part of his article as follows: "To produce freely as individuals; to associate and act in concert with others; to stimulate production when there is a scarcity of commodities; to regulate it and restrain it when there is a glut—these things, whether they be don by individuals or combined action, ar prime elements of 'liberty' of trade. They are also constitutional rights, and, when used with a due regard to the rights of others, are beyond the reach of hostile or repressive legislation. Though corporate charters should be arbitrarily repealed in some form, the liberty of association would survive to producers."

A Partnership.

In a former passage the same learned author says: "A trust is but a great partnership, regulating prices, and imposing obligations upon all the members of it not to interfere with its regulations." His arguments may be put thus: If A and B go into the wheat business together, does any one doubt that they may agree in their articles of co-partnership that neither member of the firm shall come in competition with the firm, and that wheat shall not be produced for more than a certain price nor sold for less than

a certain other price; no one doubts that A and B, as patrners, may agree thus, and enforce their agreement in the courts. It is a part of our common law.

Opposite Opinions.

"Now," says Dwight, "what possible difference can it make in philosophy or law, whether, in making up a partnership, a group of individuals enter into the firm as a group agreeing with another group, or whether all enter individually? May A, B, C and D, acting as a group of persons, contract with E, F, G and H, considered as another group, to constitute a firm, as well as if the eight persons represented had had no prior business relations with each other? If so, we have substantially a trust." Dwight's reasoning is ingenious, but opposite views on this subject are not without great force. Ever since the days of Lord Coke, who, in the great and leading "Case of Monopolies," declared that a monopoly was illegal and void, the common law has, over and over again, been asserted in the teeth of all persons who by various schemes and devices have combined to unite and regulate prices. Lord Coke mentioned three results of a monopoly of any article as inevitable: (1) That the price of the same commodity will be raised; (2) that the commodity is not so good as before; (3) that it tends to the impoverishment of divers artisans, artificers, and others."

The trust shall plead guilty of having caused these results and many more injurious to the public. Up to this time trusts, as such, have not been declared illegal by the courts. The question of the public welfare has just begun to be considered; but when the question of their legality does arise the indications are that public policy will lead the courts to declare them illegal.

In a case in Ohio, where an agreement that aimed to prevent competition in salt was sought to be legally enforced, the court used the following language: "Public policy unquestionably favors competition in trade, to the end that its commodities may be afforded to the consumer as cheaply as possible; and is opposed to monopolies that tend to advance market prices to the injury of the general public. The clear tendency of such an agreement is to establish a monopoly and destroy competition in trade; and for that reason, on the grounds of public policy, courts will not aid in its enforcement. It is no answer to say that competition in the salt trade was not in fact destroyed, or that the price of the commodity was not unreasonably advanced. Courts will not stop to enquire as to the degree of injury inflicted upon the public; it is enough to know that the inevitable tendency of such contracts is injurious to the public."

Great Number of Trusts.

THEIR PROBABLE FUTURE.—William W. Cook, an eminent lawyer of the New York bar, says in an article on the growth of trusts, "It is currently reported and believed that the trust monopolies have drawn within their grasp not only the kerosene oil and cotton-seed oil, but sugar, oatmeal, starch, white corn meal, straw paper, pearl barley, coal, straw board castor oil, linseed oil, lard, school slate, oil cloth, salt, cattle, gas, street railways, whiskey, rubber, steel, steel rails, steel and iron beams, nails, wrought-iron pipes, iron nuts, stoves, lead, copper, envelopes,

paper bags, paving pitch, cordage, coke, reaping and binding and mowing machines, threshing machines, plows, glass and water works." This statement is not overdrawn. The press almost daily heralds the formation of some new trust. There can be little doubt that, unless something prevent, the business of the country will before very long be mainly done through trust organizations.

President Roosevelt, in an address at Pittsburg, uttered some timely warnings against the dangers of trusts. He said: "Especially great, especially difficult are the problems caused by the growth and concentration of great individual, and, above all, great corporate fortunes. It is immensely for the interest of the country that there should be such individual and corporate wealth, as long as it is used aright, and when not used aright then it becomes a serious menace and danger.

President Roosevelt's Views.

"The instruments, the methods with which we are to meet these new problems must, in many cases, themselves be new, but the purpose lying behind the use of those methods, of these instruments, must, if we are to succeed, be now, as in the past, simply in accord with the immutable laws of justice and right. [Applause.]

"We may need, and in my belief we shall need new legislation, conceived in no radical or revolutionary spirit, but in a spirit of common sense, common honesty and resolute desire to face facts as they are. [Applause.] We shall need then new legislation, but while laws are important it is infinitely more important that they should be administered in accordance with the principles that have marked honest administration from the beginning of recorded history." [Applause.]

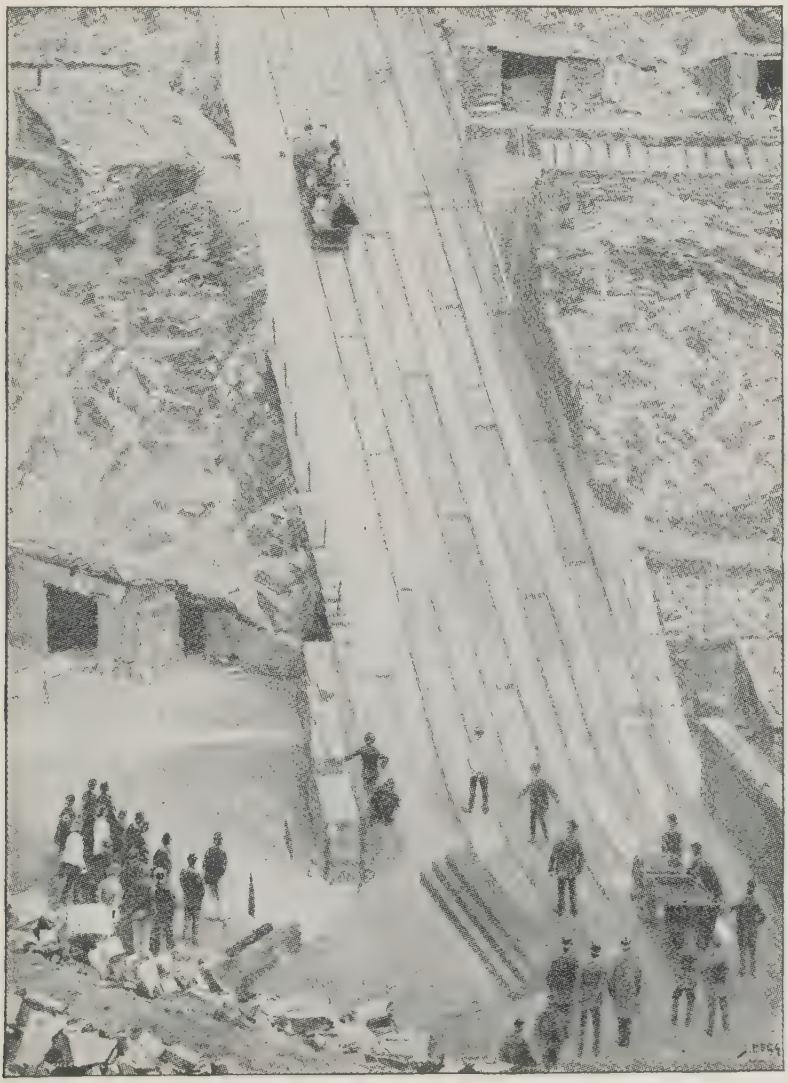
The President spoke the language of common sense. He deprecated hasty and intemperate legislation, which is sure to place obstacles in the path of progress; crude efforts to curb great industrial enterprises just because they are conducted on a large scale mean disaster to our prosperity. Ill considered anti-trust legislation in some of the Southern and Western States has failed because it was of the kind that would fall with equal severity upon the just and the unjust, and any statutes framed so as to interfere with partnerships or the employment of large capital, simply because business is carried on by wholesale, are doomed to defeat as unwise and unjust. But because the task of meeting the difficulties is great that is no reason for shrinking from it, and these remedies the President suggested:

"Much can be done along the lines of supervision and regulation of the great industrial combinations which have become so marked a feature in our civilization.

"Special legislation is needed. Some of that legislation must come through municipalities, some through States, some through the National Government, but above and beyond all legislation we need honest and fearless administration of the laws as they are on the statute book. [Applause.] Honest and fearless administration of those laws in the interest neither of the rich man, as such, nor of the poor man, as such, but in the interest of exact and equal justice to all alike, rich and poor, is one thing that is imperatively needed."

USES MADE OF SLATE

THE color of slate is a dull blue, grey, green or black. It splits into thin plates that are altogether independent of the layers of deposit; though sometimes coinciding with them, they more frequently cross them at different angles. True slate is a very compact rock, little liable to be acted upon by atmospheric agencies. It is chiefly obtained from Palaeozoic strata, but it is found also



TOURISTS ASCENDING ONE OF THE INCLINES IN A QUARRY.

among more recent rocks. It is used for various purposes, being split into thin slabs of small size for the roofing of houses, and into larger slabs for fitting up dairies, etc., and even for making billiard-tables, and split and polished by means of pumice for writing tables.

It is very largely used also for enameling; the surface of enameled slate being made to represent marble of all kinds with wonderful accuracy and resisting almost all wear. Thus, for mantelpieces, billiard-tables, ornamental slabs and furniture, it has no equal, its cheapness being such as to drive other materials out of the market. There are valuable quarries of slate in Vermont, New York, Pennsylvania, Maryland, etc.

One would naturally suppose that a slate roof would be the coolest of any. You often hear people say that a thing is as cold as a stone. When once a stone is hot it retains the heat, and if very hot it would be hard to find anything much hotter. Slate roofs are not as cool as those covered with shingles or even tin. Excavating the slate is an interesting process, and our illustration shows how the quarries are reached by an incline plane and machinery.

CANADIAN PACIFIC RAILWAY

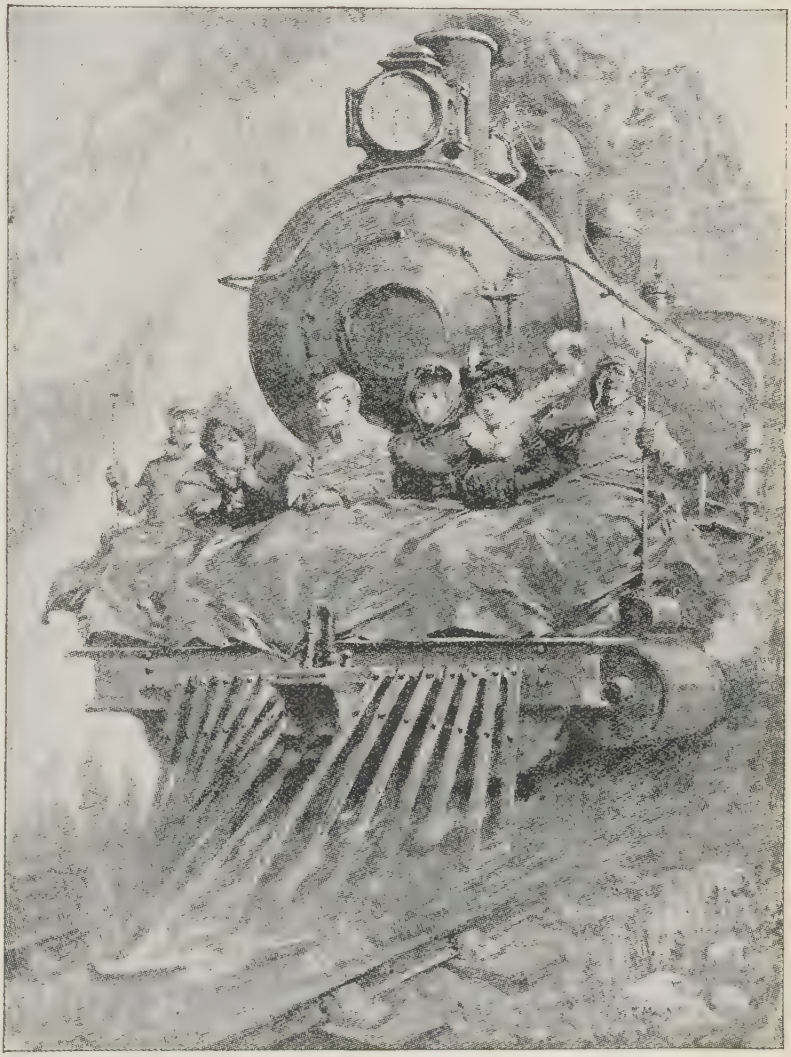
Iron Road from Ocean to Ocean—Resources of all Parts of Canada Made Accessible.

THE railway was finished in December, 1885, nearly six years before the stipulated time, and through trains are now running daily from the Atlantic to the Pacific. By this route the distance from Liverpool to Japan and China is shorter by 1000 miles than by way of New York and San Francisco. The construction of this railway and the Intercolonial Railway cost Canada about $120,000,000. The railway is not only of importance locally to Canada, as connecting the various provinces and opening up the vast Northwest Territories for settlement, but it is of imperial importance as providing a new route to Australia and the East, available for commerce, and for military and naval purposes.

Lines of steamers are passing between British Columbia and China, and the Imperial and Canadian governments having agreed to grant a subsidy of $300,000 (two-thirds being contributed by the former, and one-third by the latter) for ten years, the service is improved and accelerated.

On the occasion of the visit to Canada of the Duke and Duchess of York, the

royal party passed over a part of the Canadian Pacific road. As is well known, the scenery along many parts of the road is superbly grand. Mountain peaks come into view, towering toward the sky, while far below them stretch away landscapes clothed in the various colors of vegetation, presenting a spectacle which once seen is not likely ever to be forgotten. Many parts of Canada are very rich in metals. Particularly the western province British Columbia has developed great wealth by its mines of copper, and other metals in less abundance. Capital is flowing into this section and there are large mining industries employing thousands of men. The Ganby Mining and Smelting Company, of Grand Forks, is one of the richest concerns of its kind on the continent.



LADY MINTO AND PARTY RIDING ON A COWCATCHER ON THE CANADIAN PACIFIC RAILROAD.

When the royal party was in Canada it had a novel experience. A little of the spirit of adventure showed itself, and when the famous loop beyond Glacier Station on the way to Vancouver was reached, Lady Minto and a party of five others, warmly wrapped up, mounted the cow-catcher and rode on it throughout the loop, a distance of fifteen miles, greatly enjoying the novel experience and the wonderful view thus obtained. It has often been said and truly that the scenery of the Canadian Pacific road rivals that of any other part of the world.

DIAMOND FIELDS

Vast Wealth and Trade Interests in South Africa. Kimberley Mines Nearly Supply the World.

THE declaration of peace in South Africa was followed by the reopening of the greatest gold producing mines of the world, and presumably by a general revival of business in that greatest consuming section of Africa.

The commerce of Africa amounts to over $700,000,000, of which $429,000,000 represents the value of the imports. Necessarily, in so large an area, with so many tribes and peoples who keep no records of their transactions, a considerable amount of commerce must pass without being recorded in any way. The total imports at the ports where records are kept amounted in the latest available year to $429,461,000, and the exports to $263,907,000.

Of the exports, a large share, especially those from the south, is gold and diamonds; in the tropical region, ivory, rubber, palm nuts and gums, and in the north a fair share of the exports are products of agriculture, cotton, coffee, cacao, spices, dates, etc. The export figures of recent years are less than those of former years, owing to the hostilities in South Africa, which have both limited production and increased local consumption.

A very large proportion of the trade with Africa is with England. There are numerous reasons for this, the most important, however, being that her colonies, Cape Colony and Natal, on the south, are avenues through which pass most of the goods for that section, and that a very large share of the growing trade is also carried by British vessels, while the bulk of the mining, as well as the stock raising and general development of that section, is in the hands of British colonists or capitalists. In the north a large share of the trade of Egypt is given to Great Britain, whose influence in the management of Egyptian affairs is well recognized, while in Algeria, which has a large trade, a very large proportion is with France, the governing country.

The total recorded imports into Africa, aggregating in the latest available year $429,461,000, were distributed as follows: Into British territory, $157,575,000; French territory, $92,094,000; Turkish territory, $77,787,000; Portuguese territory, $20,795,000; German territory, $8,336,000, and into the Congo Free State, $4,722,000.

Railroad development in Africa has been rapid in the past few years, and seems but the beginning of a great system, which must contribute to the rapid development, civilization and enlightenment of the Dark Continent.

Already railroads run northwardly from Cape Colony about 1500 miles, and southwardly from Cairo about 1200 miles, thus completing 2700 miles of the proposed "Cape to Cairo" Railroad, while the intermediate distance is about 3000 miles.

African Railroads.

At the north numerous lines skirt the Mediterranean coast, especially in the French territory of Algeria and in Tunis, aggregating about 2500 miles, while the Egyptian railroads are, including those under construction, about 1500 miles in length.

Those of Cape Colony are over 3000 miles in length, and those of Portuguese East Africa and the Transvaal are another thousand miles in length. The total length of African railways is nearly 12,500 miles, or half the distance around the earth.

The gold and diamond mines of South Africa have been and still are wonderfully profitable. The Kimberley diamond mines now supply 98 per cent. of the diamonds of commerce, although their existence was unknown prior to 1867, and the mines have thus been in operation but about thirty years. It is estimated that $350,000,000 worth of rough diamonds, worth double that sum after cutting, have been produced from the Kimberley mines since their opening in 1868-9, and this enormous production would have been greatly increased but for the fact that the owners of the various mines there formed an agreement to limit the output so as not to materially exceed the world's annual consumption.

Equally wonderful and promising are the great "Witwatersrand" gold fields of South Africa, better known as the "Johannesburg" mines. Gold was discovered there in 1883, and in 1884 the value of the gold product was about $550,000. It increased with startling rapidity, the product of 1888 being about $5,000,000; that of 1890, $10,000,000; 1892, over $20,000,000; 1895, over $40,000,000, and 1897 and 1898, about $55,000,000. Work in these mines was practically suspended during the war in progress in that section within the last two years.

Immense Gold Product.

The gold production of the "Rand" since 1884 has been over $300,000,000, and careful surveys of the field by experts show beyond question that the "gold in sight" probably amounts to $3,500,000,000, while the large number of mines in adjacent territory, particularly those of Rhodesia, whose output was valued at over $4,500,000 per year, gives promise of additional supplies, so that it seems probable that South Africa will for many years continue to be, as it is now, the largest gold producing section of the world.

Diamonds cannot be called a common stone, but on the score of geographical distribution gold must be deemed a common metal, as common as copper, lead, or silver, and far more common than nickel, cobalt platinum, and many others. Theorists have propounded curious rules for the occurrence of gold on certain lines and belts, which have no existence but in their own fancy. Scarcely a country but has rewarded a systematic search for gold, though some are more richly endowed than others, and discoveries are not always made with the same facility.

FASTEST PRINTING PRESS

Monster Machine that Prints 150,000 Eight-Page Papers an Hour—Most Marvellous Printing Press Ever Made.

ALL records in the wonderful art of printing are broken by the "New York Herald." It has now at work in its pressroom a press that prints 150,000 eight page papers an hour, or 2500 a minute. A few years ago, when the first of the modern web perfecting presses was seen turning out newspapers already folded and counted from a continuous roll of white paper at railroad speed, that style of machine was considered a wonder.

To-day the mammoth press here described does the work of twelve of those presses. It is twelve presses in one, and folds, counts and delivers the papers in bundles of fifty, ready for carriers and newsdealers, at the rate of 150,000 complete eight page sheets per hour. More "intelligent" machinery does not exist.

This press sweeps the gamut of mechanical ingenuity—from the most delicate chronometer to the swiftest locomotive. Twenty hours is the fastest time between New York and Chicago, a distance of about a thousand miles. In half this time the big press runs more than one thousand miles of paper through its flying machinery, the papers falling, printed, folded and counted, at the little stations on either side of the great press. Such is the triumph of ideas practically worked out in machinery.

Here is a condensed description of the Goss duodecuple six-deck straightline compound newspaper printing and folding machine:

The largest and fastest newspaper printing and folding machine in the world.

Built on the straight line principle.

The word "duodecuple" meaning twelve times; it will, therefore, be readily understood that this mammoth machine has a capacity of twelve single-roll web presses.

The capacity of this machine is:—

300,000 four page papers per hour, or 5,000 per minute.

150,000 eight page papers per hour, or 2,500 per minute.

100,000 ten or twelve page papers per hour.

75,000 fourteen or sixteen page papers per hour.

50,000 eigteen, twenty, twenty-two or twenty-four page papers per hour.

All are printed, folded and delivered.

Ninety rolls, or sixty to sixty-five tons, of paper are used on one of these mammoth machines in operating for ten hours. This amount of paper would reach 1,073 miles in a straight line, or from New York to Chicago.

It requires ninety-six full page stereotype plates to equip the machine for printing.

The newspapers of various numbers of pages are delivered from six different deliveries, all automatically counted in bundles of fifty.

The paper magazines at the end and top of the machine contain, when fully loaded, eighteen large rolls, or about twelve tons of paper.

Took One Hundred Years.

In this latest press are concentrated the achievements of a hundred years. At first newspapers were printed by hand, the pressure applied by a screw. Then the lever press, half a dozen a minute. Then the lever with a toggle joint invented by Franklin, was considered a great step. When further improved it was called the Washington press, and is used to this day in some country newspaper offices, its greatest speed being from 200 to 300 impressions an hour, on one side of the paper only.

Next came the power press—an iron cylinder revolving on white paper, resting on a flat iron plate or "bed," which was moved back and forth like a shuttle under the ink roller, the big iron roller making the impression and doing the printing. Then came a cylinder bed, in which types were locked in "turtles." Likewise the invention of taking a cast of the type—a plate curved to fit a cylinder. This reversed the old process, the cylinder now covered with type and rolling on the type, and the bed of the press giving the pressure.

Then came the great presses, culminating in ten cylinders running in a single machine. It meant ten sheets of paper simultaneously fed by ten men into the machine. It was considered perfection—not to be improved. Thirty thousand an hour was its capacity, but only one side of the paper was printed at a time. The sheets had to be turned and printed on the other side before a newspaper was finished for its readers.

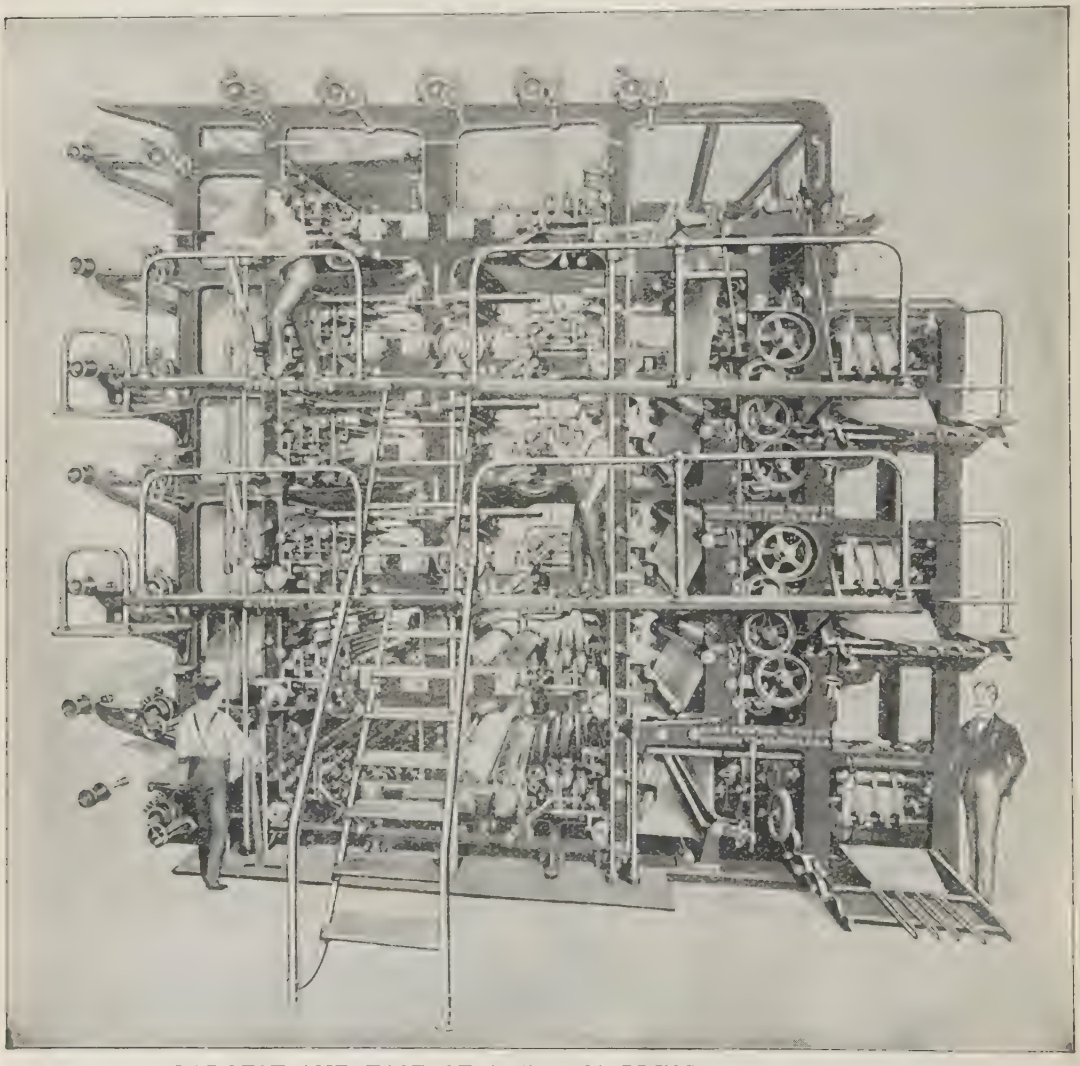
Finally came a revolution in newspaper presses. The Bullock press appeared, printing from a continuous sheet of paper, unwinding from a roll and running between type cylinders, printing both sides at once and cutting off complete newspapers, ready for folding. This was done with astonishing rapidity compared with the old system, and there were some men enthusiastic enough to predict that the system would be a success.

New Improvements.

A press exhibited at the Centennial Exhibition, in Philadelphia, in 1876, was also tried for a few weeks by one of the big downtown dailies. A rival press manufacturer predicted that the system would never work. The foreman of the newspaper said it would never work. The stockholders accepted this verdict, but other newspapers worried along with the machine at about three times the speed of the old cylinder presses and one fine day the concern that pronounced the Bullock system a failure came out with one like it—improved, they said—and since then the system of printing newspapers from a continuous roll has rolled around the world.

One of the first improvements added to the original machine was the attachment of a rotary folder. This was considered magic, and when a combined

press and folder was exhibited, turning out complete newspapers at what was considered great speed, it was thought the day of perfection had arrived.



LARGEST AND FASTEST PRINTING PRESS IN THE WORLD.

Since then marvelous improvements have been made from year to year. One, two and three roll machines were soon produced, doubling and trebling original capacity. They were practically several machines in one. Finally these machines became as large as locomotives and enabled the morning papers to go to press and catch earlier trains with enormous editions.

From Chicago came the crowning triumph—the Goss press, above referred to, the greatest and most rapid printing machine in the world. A radical feature was the doing away with cumbersome devices, printing without running the

paper over angle bars, with increased friction and unnecessary intricacies in machinery.

A very important point in regard to this press is that any section of the machine can be supplied with paper without stopping any of the other rolls. Each runs independently of the other. The power is applied direct, all the movements are positive and simple, and the result is perfect printing at express train speed. Consider some of the processes involved in making a paper. Up in the forests of Maine and the great lakes big trees are manufactured into pulp and the pulp into paper.

Machinery That Thinks.

And so it comes about that by this wonderful machinery, not of muscle, but of thought and patience and endless experiment, extending through periods of years, the spread of intelligence and news is simplified and made possible in a manner never dreamed of thirty years ago. In a word, the giant trees of the forest that were growing when the government was formed, are now sent forth in the form of paper bearing the news of the world to the grandchildren of the men living when these trees were saplings.

A bit of the Maine forest is now a work of art, covered with news and pictures. You put on a postage stamp and send it to your friend, and he knows more to-day than twenty men did yesterday. Statesmen are instructed, members of the government given the latest news from Europe and ideas are spread broadcast over the land.

Yet the man who first conceived the making of paper out of wood was considered a "crank." The men who formed the first wood pulp company were ridiculed and maligned. And so it was with the early inventors of all these improvements which make printing the marvel it is to-day. The last improvement of vital importance to the press is an equally wonderful machine called the autoplate, or stereotyping machine.

For twenty years no progress was mad in the art of stereotyping. The metal fo a plate was melted in a caldron and poured by hand into stereotype moulds. Then the plate was removed and finally made ready for the press. It required about thirteen minutes to make the first plate, and then a minute each for the following plates, until enough had been cast to supply the presses.

Great Saving of Time.

By the new invention of Mr. Henry A. Wise Wood, the plates are automatically cast in a machine at the rate of three to four plates a minute, which gives every department more time to perfect its work—the pressmen more time to print the paper, more time to catch the mails—all of which is of incalculable value in giving readers at home and abroad the latest news.

But this is not all. By the use of this new stereotyping machine, or "autoplate," the work is so much better done that the paper is greatly improved in appearance, both typographically and artistically. The print is clearer, the half tone pictures are better—in a word, the machine has revolutionized the old system of getting out large editions of a great newspaper. Mr. Wood is entitled to great credit for

his invention, and for his perseverance in perfecting it.

When he first proposed making such a machine, it was doubted if it could be made to work successfully. Mr. Wood believed in it, and when he called on the "Herald" he found cordial support. He then decided to undertake the formidable task. After a year's hard work, the machine began to assume practical form, and, after two or three years and an expenditure of $50,000 or $60,000 in experiments, it seemed certain of success.

Victory for Labor.

But much more time and money were expended until it was finally completed in the form now at work. The old saying, "No excellence without labor," holds good in making a newspaper as in all other departments of industry and thought. It is like a miracle, this daily achievement, making the great daily newspapers.

The events of a single day—the ship that goes ashore in the Black Sea; the wreck that is found off the Norwegian coast; the event in English society; the changes in European cabinets; the change of policy in China; the floods in New Jersey; the millionaire's gift to New York; the romance in Chicago; the latest oil discovery in Texas; the big gold find in the Klondike; the boy that saved a family in Tennessee; the speeches delivered in London or Washington involving affairs of State, these and many news features of great events, pictures of life and politics, news of governments and financial exchanges—all these "happenings" in every part of the world are gathered by correspondents and flashed over mountains and under seas to the newspaper bureaus in every capital and country worth talking about, forwarded to Paris, London, Hong Kong and San Francisco, thence to New York, carefully edited, put into type and printed for the world to read at breakfast next morning.

Forests Turned to Paper.

The accomplishment of this magic feat of a day and a night is made possible by these inventions that turn forests into paper and newspapers by the carload, and spread the news of the globe before the inhabitants of distant continents.

This is why Mr. Depew remarked one day to a clergyman who was bewailing the eccentricities of some frivolous editor: "But we owe everything to the press. One might as well expect to do without railroads, schools and churches as without newspapers. They are liberty enlightening the world."

Paper is not now made spongy and stretchable by being wetted, and the result of working it dry is that the type is brought up with greater brightness, and the delicate lines of engravings are printed finer, clearer, and cleaner. Improvements in ink-making have much conduced to this desirable result. Paper has been produced for book-printing with a specially prepared surface, which admits of a far more excellent impression than that formerly procurable. The soft blanket has been discarded, and the packing or covering of the cylinder is now generally as hard as it can be got. The aggregate results of these alterations may be seen by a comparison of the present issues of an illustrated newspaper with those of fifty years ago.

SCENES IN CENTRAL AFRICA

Old Mosque Near Timbuctoo—River Niger—Market Place.
Odd Forms of Native Huts—Camel Warfare.
Niger Chiefs—Ju-Ju House.

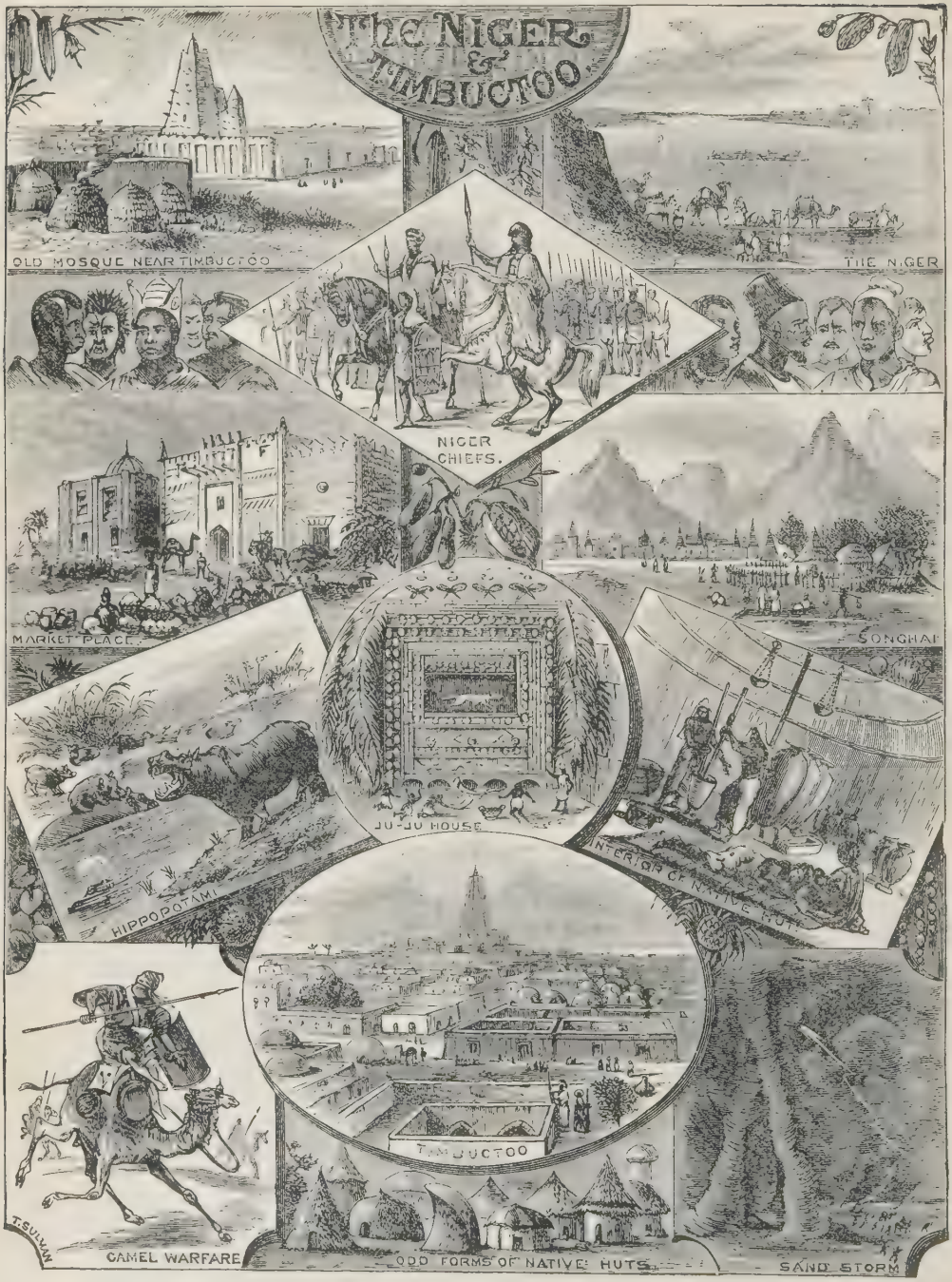
THE Niger is the third in length of all the rivers in Africa. The Congo and the Nile are longer, but the Niger sends down a larger volume of water. From the borders of Sierre Leone to the Gulf of Guinea, it is 2600 miles in length; forming a right angle from east to south in the centre of its course.

Travelers speak of it as a noble stream, slow but with a few rapids. It has many names. The Niger, the Joleba, the Quorra; and they all mean in native tongues, the "great water," or the "father of rivers." It rises amongst some remarkable hills, shaped like gigantic turreted castles. Ranges of saw-shaped mountains attract the rain clouds from the Atlantic, and a network of rivulets unites to give birth to the upper Niger; even here, it is 500 feet broad and 3 to 6 feet deep. It teems with fish; the flooded banks yield large rice crops; and the people on its shores are prosperous, active and peaceful.

Then it enters the desert zone, and the landscape changes. For many hundred miles it receives no tributaries, and loses much of its water in the thirsty sands. The people, too, are different; warlike, restless Arabs roam on their swift camels, plundering caravans which conduct all commerce between Timbuctoo, Boussa, and Soboko. This is the Western Soudan. The inhabitants are jet black, brave, but cruel. By religion, they are Mohammedans; by practice, slave dealers. Still, the Niger flows on, entering British territory, till, 450 miles from its mouth, the first steamboats are met. Here the river changes once more. It divides into many channels and forms a great delta, covering at least 10,000 square miles. It is a vast network of muddy slow channels of endless mangrove thickets of bogs and quagmires, and haunted by crocodiles and pythons; while fevers are more deadly to Europeans than even a battlefield.

The Niger has attracted many explorers. Mimgo Park, one of the best known, was a young Scotch doctor. He started from Sierre Leone with a small party in 1795, and spent ten years exploring the river. One by one his white companions died, till at last, lonely and ill, he reached Boussa. Here he found means to send off his journals and river maps to the coast and then to England. Shortly afterwards, when crossing the rapids to escape some hostile tribes, he was drowned, in 1806. Mimgo Park told a touching story of the kindness of a Bambara negress, who sheltered and fed him when he was footsore and in dire distress. He heard her singing him to sleep as she sat spinning: "Let us pity the poor white man, no mother has he."

In 1830, Messrs. Clapperton and Lan-



don followed in Mimgo Park's footsteps, and lifted the veil from much of that mysterious river.

The shores of the Gulf of Guinea are densely wooded, and a tremendous surf makes landing a great danger.

Timbuctoo.

It is situated near the bend of the great river at its most northerly angle. Very few Europeans have ever entered it. Dr. Barth was there in August, 1852, and described it as a large triangular walled town, about three miles round. It is a mass of closely packed, poor houses of clay and slate. The streets are so narrow that two horses seldom can pass abreast, and most of the houses have terraced roofs. There is a large market place, in which is the great mosque shown in our picture.

Mohammedan Mosque.

This mosque is the Mohammedan church, 270 feet long and over 200 feet wide. Timbuctoo has 13,000 inhabitants. It is a place of large trade in gold dust, ivory, ostrich feathers, salt, blue cloth, weapons, embroidery, and very rich leather work. Caravans are constantly arriving and leaving. Timbuctoo is often the scene of civil war between neighboring tribes. The slave trade which, alas! still flourishes, is the cause of vast suffering and disorder. The town lies six miles from the Niger, which is there called the Quorra. Kabia is the port for Timbuctoo.

The Tshadda—the largest of the eastern tributaries of the Niger—has not yet been fully explored. It has been thought to drain the great lake Tchad, which varies much in size according to the season. It is said to be 130 miles long and 80 wide, but seldom more than 6 to 10 feet deep. Its shores are labyrinths of channels and islands of giant reeds. They abound with hippopotami, crocodiles, turtles, and innumerable birds. The natives are gentle and intelligent. They live much on the water, gliding from place to place on swimming boards. They own great droves of humped cattle and goats. The Sultan of Sokoto imports annually 1,500 camel loads of blue cotton cloth from Timbuctoo.

There seems to be no great negro empire in the Western Soudan, only a large number of tribes and independent villages. English commerce is gradually extending from the south, and it is thought that there will be before long a great increase of wealth and trade along old Niger's busy banks. Our picture shows in the centre Timbuctoo, from a view by Dr. Barth, and also the old mosque near the city. Soughai is a prosperous town in the north. The warrior is a member of one of the much-feared desert tribes. The "Ju Ju House" is from the south, where the cruelties of witchcraft, too painful to relate, are practised. Another sketch gives some of the odd shapes of native grass-thatched huts.

Abounds in Wild Animals.

Animal life is abundant. Lions, leopards, tigers, cats, elephants, rhinosceri, are common.

Amongst birds are guinea-fowls, storks, cranes, flamingoes, parrots, and pelican, besides the boat-bill, ibis, and innumerable pigeons. In the central sandy plains, the ostrich is hunted for its plumes; and in the hot moist forests of the coast the great chimpanzee, and other of the higher apes, live in green solitudes.

All accounts of travellers in the "Dark Continent" are largely composed of descriptions of the native animals that roam through the thick jungles and dense forests.

HOW ACCIDENTAL DISCOVERIES LEAD TO GREAT FORTUNES

THE average man in the course of a lifetime, stumbles across many inventions. Singularly enough, he rarely realizes the value of his discovery and its benefits are not reaped until a more knowing discoverer brings them to the attention of the world.

Such a man becomes an Edison, a Tesla, or a Marconi, because he appreciates the value of what he has found. Some of the most useful discoveries that have benefited mankind have been the results of an accident.

Years ago a kitchenmaid at Stanley Farm, near Burslem, was boiling up some salt and water for curing pork. The vessel used was of unglazed earthenware. During her absence from the kitchen the brine boiled over and there was trouble. Subsequently, the brine refused to be scraped off the clay, but stuck to the outside of the vessel in a shiny waterproof coat.

The story of that accident came to the ears of a Burslem potter. To him it signified something more than the "wicked waste of brine" of the kitchenmaid. He pirated the unconscious discovery, "invented" the system of glazing by common salt and simultaneously gave the Staffordshire potteries one of the greatest boons they have ever experienced.

In the latter half of the eighteenth century, one of the members of a scientific society in Liverpool laid a curious wager. He bet a brother scientist that he would read a newspaper by the light of a farthing dip at a distance of thirty feet.

The challenged party finding the feat difficult at even a sixth of the distance, cheerfully accepted the wager. The layer coated the inside of a shallow wooden box with sloping pieces of looking-glass, forming a concave lens, placed this behind his farthing dip and readily deciphered the small print at the stipulated distance.

This experiment was witnessed by a Liverpool dockmaster. He was a thinking man and saw great possibilities in this learned jest. He straightway adapted the principle to lighthouse requirements and forthwith the modern reflected light, with its miles of effective range and untold life-saving powers, sprang into being.

A potter of Staffordshire named Asbury stopped at Dunstable on his way to London to obtain advice regarding the defective vision of his horse. The hostler at the inn where he stopped burned some flints and pulverized them into a fine powder. This powder he blew into the animal's eyes. Asbury was astonished that the erstwhile black flint became white with the heat. He conceived the idea that if powdered flint were added to ordinary pipe clay it would on being fired produce a harder and more serviceable white substance than ordinary clay. He tried the experiment, with the result that flintware was added to the list of British manufactures.

Lundyfoot, a well-known snuff maker, of our grandfathers' days, was once drying some snuff preparatory to presenting it for sale. By accident it was baked too long and burned beyond repair, but Lundyfoot was not cast down. Most men would have thrown away the entire stock. He decided upon a bolder course.

"High Dried" Snuff.

Making a virtue of necessity, he advertised his charred stock as the new "high dried" snuff, and started to push it for all he was worth. It had a pungent flavor all its own, and, greatly to his surprise, it found instant favor. He made a large fortune out of his "invention."

Many present-day inventions have had equally unlikely beginnings. Saccharine is the most valuable substitute for sugar we know. It can be taken with impunity by diabetic patients, to whom ordinary sugar is death, and it is many times sweeter than that commodity. Nevertheless, it has only been known to science since 1887.

In that year Dr. Fahlberg was employed upon the all-important subject of coal tar derivatives at the Johns Hopkins University in Baltimore. Sitting one evening at tea, he was surprised to find how sweet his bread and butter tasted. He traced the sweetness to his fingers, thence to his coat sleeves, and finally to one of the bowls of derivatives in his laboratory. Experiments upon himself and animals proved alike the harmlessness of the compound and its extreme sweetness. He had "discovered" saccharine.

Edison was one day walking on the sea coast when he came across a patch of black sand. Curious to know what it contained, he filled his pockets with it and subsequently turned it out on a bench in his laboratory.

Just then a passing workman stumbled against the table and dropped the big magnet he was carrying across the sand. When he picked it up again it was covered with tiny black grains proving the sand to consist largely of metallic particles.

Edison's Discovery.

Most men would have sworn and passed on. To Edison, however, this action suggested the modern process of metal extraction from low-grade ores. In this the ore is first crushed to powder and then passed between powerful magnets. The metal sticks to the magnets, while the dross passes on.

The inventor shows his genius by his ability to discover new ideas, and frequently these come to him by the merest accident. What weeks of study could not have produced by the hard reasoning from cause to effect, may be suggested by a trifle, an unexpected occurrence, which would probably mean nothing to the ordinary observer, but which to the mechanical genius may open the door to a splendid discovery.

In fact, it is the thoughtful observer in every pursuit who achieves success. The student who keeps his eyes open, the man who sees what is going on in his business, the inventor who is alert for every new thing that comes along—these are men who are greater than others, because they have sharper eyes and quicker comprehension, turning their accidental discoveries to practical account.

RUBBER TREES IN THE AMAZON VALLEY

IN Brazilian swamps grows a thrifty tree which yields the valuable Para rubber. Its glistening leaves, trifoliate in form, and light colored bark enable the rubber collector to distinguish it among the masses of luxuriant foliage of the Amazon valley.

The tree attains a height of from 70 to 100 feet. The flowering season is in the month of January. The seeds ripen from March to May. They are enclosed in a hard shell which contains three or four seeds. This shell when ripe explodes with a loud report, scattering its contents far and wide, so that it is quite difficult to find them.

Incisions are made at various heights on the trunk, usually with a thick bladed but sharp axe, which barely penetrates the bark, thus opening the tubes containing the milk or latex. The sharp edge of a tin cup, concave on one side, is pressed into the bark beneath the incision, and into this receptacle the latex flows. Large trees will carry seven cups eight inches apart, but the usual number is five or six. The latex is of a dazzling whiteness much resembling milk, except that "caoutchouc" takes the place of the butter in the ordinary milk.

The India rubber collector taps a certain number of trees and then returns to the first one to empty the cups. He carries a large jar covered with a net work of rope, into which the latex is poured from the cups. When the jar is full it is taken to the spot chosen for preparing the product for the market. The tapping of the trees does not kill them, but eventually seems to drain them of their whole supply of valuable latex.

The largest State of the United States of Brazil is Amazonas, which has a total area of 600,000 square miles, or nearly twice as large as that of our thirteen original States. The population is about 400,000. The greater part of the State consists of low-lying, forest-clad plains through which run the innumerable tributaries of the Amazon. The main stream divides the State into two almost equal parts, the northern being of higher and less swampy character, while the southern half is mainly made up of immense swampy tracts. The rainy season from January to June causes an enormous rise in the rivers, ranging from 40 to 50 feet above low water mark. The rubber tree, however, grows equally well on the uplands, which are rarely flooded, on the lowlands, almost always under the water, and in the intermediate districts.

The variety common to Amazonas districts is called the Casca Prete. Its product is more valuable than that of either the upland or lowland tree. The

latex or milk of the lowland tree is thin and watery, while that of the highland is so thick it will not run.

That the product of a tree found in vast luxuriance in the dense forests

TAPPING RUBBER TREES IN THE AMAZON VALLEY.

of Southern America should, within comparatively few years, by the applications of skill, be brought into manifold uses—alike characterized by their ingenuity and importance—is certainly one of the marvels of our scientific age. Such, in brief, is the history of India rubber and its manufactures. India-rubber was first brought to England in 1767, and is thus mentioned in a letter from Sir Joseph Banks to Mr. Canton, in the archives of the Royal Society: "With this you will receive two balls of the new Elastick Substance." In 1772, Dr. Priestly thus speaks of the new substance:

"I have seen a substance excellently adapted to the purpose of wiping from

paper the marks of a black lead pencil. It must, therefore, be of singular use to those who practice drawing. It is sold by Mr. Nairne, the mathematical instrument maker, opposite the Royal Exchange. He sells a cubical piece of about half an inch for three shillings; and he says it will last several years."

Thought to be Useless.

Many persons (says Mr. Thomas Hodgskins, the experienced writer on subjects of political and commercial economy) yet alive remember when India-rubber was only known as part of a stationer's stock, in the shape of little black flexible bottles, more or less ugly, and when it was only used to rub out pencil marks. Now it fills a large place in the arts.

Instruments to relieve pain and carry on war; toys to amuse children, and buffers quietly and smoothly to stop the impetuous railway train; the softest and most yielding of all beds; the most impermeable of clothing; the most flexible of tubes; the valves which approach the nearest to the most delicate and exquisite contrivances of nature to carry on the functions of life, but rudely imitated in the most ingenious of our contrivances, pumps and steam-engines, etc., are all now made of India-rubber. Hardly any business of life is carried on without its aid.

It is used in our printing-offices, it forms a link in telegraphic communication, and is indispensable on railways; it guards the traveler from atmospherical evils; it enables the diver to traverse the bottom of the ocean; it is essential to balloons; it stretches and contracts like our own skin, and is a necessary part of the most useful, convenient, and graceful dresses. Without it civilization would have been as effectually stopped as we by its means stop the train; and the discovery of it and its many uses, like the discovery of gold and its great use as money, the best known and most precise measure of all the services which men render one another, is a necessary part of human progress.

Nevertheless, one of the most extensive of these useful applications was known in South America upwards of a century since, where cloaks were then waterproofed with India-rubber; and disinclined as we are to rob Mr. Macintosh of the merit of his adaptation, the invention must be awarded to another age; indeed, it is almost one of the antiquities of the New World.

Profitable Trees.

In a work printed at Madrid in 1723, we find a chapter devoted to "Very profitable trees in New Spain, from which they distil various liquors and resins." Among them is described a tree called "ulquahuill," which the natives cut with a hatchet, to obtain the white, thick, and adhesive milk. This, when coagulated, they made into balls, called "ulli," which rebounded very high when struck to the ground, and were used in various games. It was also made into shoes and sandals.

The author continues: "Our people (the Spaniards) make use of their 'ulli' to varnish their cloaks, made of hempen cloth, for wet weather, which are good to resist water, but not against the sun, by whose heat and rays the 'ulli' is dissolved." India-rubber is not known in Mexico at the present day by any other

name than that of "ulli;" and the oiled-silk covering of hats very generally worn throughout the country by travelers is always called "ulli."

Shoes have also long been made of rubber in its native country. Edwards, in his "Voyage up the Amazon," witnessed the process of making these India rubber shoes, which he thus describes: First, the lasts are made of wood from the United States; they are smeared with clay to prevent adhesion, and the leg of each is a long stick, to serve as a handle. The lasts are dipped into the rubber milk, and are then held over the smoke of a fire made with a species of palm-nut, which dries the surface at once. The lasts are then redipped; and the process is repeated until the shoes are of sufficient thickness, a greater number of coatings being given to the bottom or sole.

A shoe is thus made in a very short time. It is then placed in the sun for a few hours, and changes from a yellowish hue to a reddish brown; it is next figured by girls with small sticks of hard wood, or the needle-like spines of palms, and is fit for sale.

M. Claussen, the botanist, when traveling in South America, found a tree which produces India-rubber, growing on the high plateaux, at from 3000 to 5000 feet above the sea-level. It bears a fruit in form not unlike a bergamot pear, and full of milky juice, which is liquid rubber. To be eatable, this fruit must be kept for two or three weeks after being gathered, in which time all the India-rubber disappears, or is converted into sugar; and it is then in taste one of the most delicious fruit known, and regarded by the Brazilians as superior to all the other fruits of the country. Thus this remarkable tree serves a double use.

INGENIOUS CANAL

THE Dortmund Ems Canal in Northern Germany has proven a great boon to commerce. As transportation by water is far cheaper than by rail the exports of coal and iron have increased immensely. Many difficulties were to be overcome in building this canal. It had to be built through a large coal region where the territory was literally covered with railroad tracks which were used in transporting the coal.

Of course, the building of a canal necessarily interrupted traffic and proved of serious damage to the railroad. Another obstacle was that it was discovered that not enough water was at hand to fill the numerous sluices which were necessary to the passage of the great number of boats through the canal.

However, to modern engineers it does not take long to accomplish a desired end. Instead of a number of sluices a huge

elevator was erected at Henrichenbury which lifts ships of a capacity of 1000 tons. At the latter city there is a difference in the water level of over 45 feet, and it is considered a great feat to have the boats transported in the manner as above described.

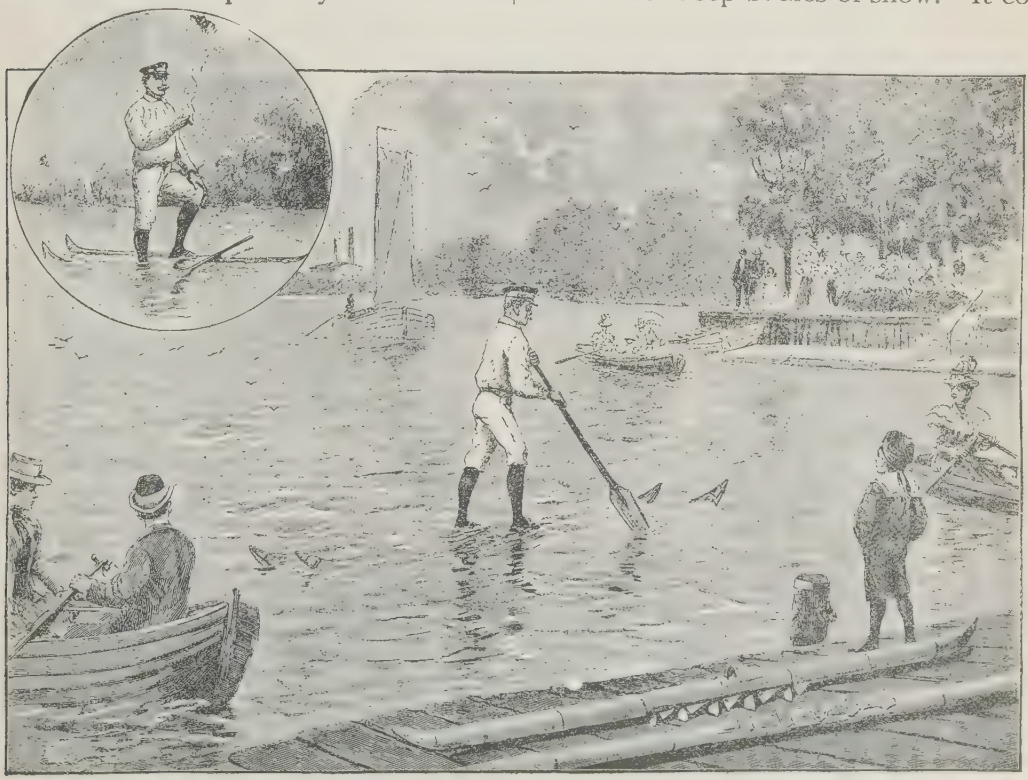
ELEVATOR FOR LIFTING AND LOWERING BOATS ON THE DORTMUND EMS CANAL, GERMANY.

The skill of the engineer, that kind of genius which overcomes obstacles, is seen in this ingenious method of transporting boats. The old-fashioned canal lock is superseded, and in its place we have an invention that answers better. Thus improvements in all kinds of transportation are going on. Both by railway and water vast quantities of all kinds of products are daily transferred from this place, thus bringing the ends of the earth together

WALKING ON WATER

OTTO GROSSMAN, a fisherman of Halle, Germany, has invented a shoe that will enable him to walk on the water. He was repeatedly seen on the river Saale, walking with apparent ease on the water against or with the stream.

At Trotha, he rescued a man from drowning. He created immense excitement wherever seen, and was induced to perform his feats on the Spree at Berlin, walking the whole of the distance between Halle and Berlin on water.



INVENTOR OF THE GROSSMAN SHOE WALKING ON THE WATER.

The principle of the water-shoe is the same as that of the snow-shoe, which has long been in use by persons who have to travel over deep bodies of snow. It consists in obtaining a large surface for bearing the weight of the body. This prevents the danger of sinking.

Even then no little skill is required for moving forward, and the muscles of the lower limbs are apt to be severely taxed by the effort, until the art of walking is learned by practice.

SOCIAL LIFE OF ANTS

Interesting Stories of these Intelligent Little Insects.

PROF. AUGUST FOREL of Switzerland published in the "International Review" two articles under the above title. Some most interesting facts are given by him. The most characteristic of the slave holding ants are of the genus Polyergus, the reddish, or Amazonian ants of Europe and several American species. In these ants the mandibles or jaws are toothless and have developed into two curved poniards.

These ants have lost the instinct for work and even for nutrition; and their slaves have to do everything for them even to disgorging food into their mouths. As they are incapable of caring for their own offspring, they collect in phalanxes on fine afternoons in July, August and September, in preparation for marauding expeditions. The Amazons leave the nest at a signal from the leaders of the movement, given by striking with the forehead and they set out in serried ranks in a direction already determined, moving at the rate of a foot in forty seconds on the turf, and in twenty-five seconds on bare ground.

The expedition advances without hesitation in a straight line, the leading ants sometimes stopping to reconnoitre. The host then scatters, each one feeling around with its antennae, until finally one or more ants hit upon the right way, start off rapidly, and give the signal with the forehead to others. The line of march is then resumed, often, however, in a new direction—by a cross-road as it were.

Several halts of this kind may happen in the course of one expedition; sometimes they are momentary; sometimes they last a long time; and occasionally the whole force has to abandon the movement and return to the home nest, after accomplishing nothing. Usually, however, fortune favors the bold and strenuous.

The author says: "Generally they manage to light upon some nest of formica fusca, or rufibarbis, dash at the entrances, which they widen if necessary, penetrate into them in dense masses, and emerge a moment later, each carrying with its mandibles a larva or a nympha, with which they hurry back to their own home. They attempt neither to do the least harm to the working ants of the nest they storm, nor to take possession of it.

"But the poor ants thus robbed defend themselves and try to rescue their nymphae. When they grasp an Amazonian ant by the leg, so as to hold it back, the latter passes its mandibles over the nympha and threatens to run its assailant

through. If the fusca or rufibarbis ant does not then let go its brain is transpierced; its mandibles are thus paralyzed and the Amazon goes off with its booty. There is never any hesitation on the return march of the army; the trip to the foe's nest has sufficed to make each ant acquainted with the exact road."

After More Plunder.

Sometimes the Amazons throw the captured nymphae to the slaves to be cared for and go back for more plunder; and sometimes they remain in their own nest, or make another expedition next day; and in that case there is never any hesitation as to the proper route. Moreover the second expedition depends upon whether the captured nest has more booty or not; and these facts are regarded by Forel as showing in the ants the faculty of memory. He has observed in the course of a single summer forty-four such expeditions, on thirty different afternoons, by one swarm of these Amazonian ants; and they must have brought home that season 29,000 slave nymphae.

At home the Amazonian ants saunter round, and merely call upon their slaves to disgorge honey for them. The slaves build their nests and do all the work, like mistresses of the house, and if they wished they might starve their masters to death. These fighting ants afford the best opportunities for observers, as their signs can be noted, their communication with one another by means of the antennae, their memory for places, their mode of determining direction, and their scouting parties.

"They are, of course, remarkable for their courage, love of fighting, and instinctive tactics. They are afraid of nothing, and do not hesitate to attack numerous troops of ants larger than themselves, such as formica sanguinea and formica pratensis. They spring upon them, bustle them about, pierce the brains of any that seize them by the legs, and die biting rather than flee. I have never seen a single one retreat.

"When two armies of this species are set over against each other, they mutually annihilate each other. It is, therefore, easy for a small company of these ants to create a panic in a numerous army of another species larger and stronger than themselves. I have seen a handful of sixty Amazons put to flight a whole swarm of the huge formica sanguinea, comprising probably 2,000 ants, after a quarter of an hour's fighting. The panic among the sanguineae was such, that in less than ten minutes they had all evacuated their nest, leaving behind them on its surface a thick layer of more than a million nymphae."

They Can Reason.

The author does not deny that many of the actions of ants are instinctive, but he insists on their reasoning capacity. He says that when an ant finds a suitable spot for home twenty feet from a damaged nest, she goes back and brings members of the community to the chosen place, sometimes by sheer force, and then begins nest building with the help of these recruits and conscripts, it does not matter whether you call her actions co-ordinated and subsequent reflexes or not; their character is clear enough, whatever words are used.

It is something of a proof of foresight, too, that ants care as they do for the aphides, coccides, the larvae of the tilligo-

to the roots that run through the nest.

Lombroso, in search of crime every-

WHITE ANTS AND THEIR DWELLINGS.

metres, and the caterpillars of certain butterflies; which are their milch cows so to speak. They watch over them, move them, build them sometimes stables of stone, defend them, and transport them

where, has studied ants and found among them criminal propensities; but Forel, after giving one of the Italian's illustrations in criminology, offsets it with a story of sterling patriotism: "In order

not to leave my readers under the impression of crime among ants, I insert the account of a trait of devotion to the common weal. A swarm of formica pratensis was closely pressed in its nest by an army of the same species, and crowds of alarmed defenders issued from the entrances to the nest and flew to take part in the fight. Like Satan, the tempter of old, I placed near them a beautiful drop of honey on a piece of paper.

Death, Instead of Honey.

"At any other time the honey would have been covered in a few instances with ants gorging themselves, but this time, numerous working ants came upon it, tasted it for scarcely a second and returned to it restlessly three or four times. Consciousness, the feeling of duty, invariably prevailed over gormandism, and they left the honey to go and be killed while defending the community. I am bound to own, however, that there are ants less social, in whom gormandism does prevail."

It is related of Dr. Livingstone, the great African traveler and explorer, that on one occasion he noticed a gigantic tree, made still taller by growing on an ant-hill twenty feet high, to which fire had been applied near the roots. These ants construct their nests with covered galleries, and far surpass bees, wasps, or beavers in the art of building, and in sagacity and government.

There are several species, and some build on the ground, others on the branches of trees, often at great heights. The largest species is best known on the coast of Africa. It erects immense buildings of well-attempered clay. In Senegal they resemble the villages of the natives, being ten or twelve feet above the level of the ground, and like very large haycocks. Comparing the size of the animal with that of man, these buildings are to the ants what four times the height of the Washington Monument would be to us.

Every building consists of two parts, an exterior dome and an interior, divided into an amazing number of apartments. The exterior is a protection from the weather, and in the intertor reside the king and queen, and the whole community, with magazines stored with provisions and conveniences.

How They Build.

They raise the immense structure in separate turrets, of the shape and size of sugar-loaves, and then fill it between till the dome is completed by joining the tops of the lofty turrets which they raise in the centre. They then take away the bases of the central turrets, and apply the clay to the construction of the interior.

The royal chamber is in the centre, in the shape of a large oven. The entrances are so small, that the king and queen can never leave it. Around it are apartments for soldiers and attendants and magazines, filled with gums and hardend juices of plants. Among these, are the nurseries for the eggs and young.

Beneath are sewers to carry off water, descending to the gravel; here subterraneous passages are carried horizontally to vast distances, like passages from old castles, from which they emerge on any building or merchandise they intend to attack. As they cannot carry up perpendiculars, all the ascents and descents

are made by spiral roads. For a communication inside they construct elliptical bridges.

The ravages of white ants are very destructive. In the island of St. Helena, the white ants were, it is supposed, accidentally introduced from the coast of Guinea. Jamestown was devastated, the cathedral and the books of the public library were destroyed. Everything in the town made of wood was more or less injured, imperiling the lives of large numbers of the four thousand inhabitants.

As Livingstone came up to a tree he heard a crack which told that the destructive element had done its work, but he felt no fear till he saw the huge bulk falling towards himself. He started back, and only just escaped being crushed. "Three times in one day," he remarks, "was I delivered from impending death." His attendants, gathering round him, and taking this third preservation as a good omen, shouted, "Peace! peace! you will finish your work in spite of these people and in spite of everything."

In the government stores it was found that the moist traces of the insect on the outside of the tin cases caused very speedy corrosion of the metal, and enabled the insects to make their way in and devour the contents, doing immense damage.

LARGEST ANIMAL IN THE WORLD

Wonderful Sagacity of the Elephant—Immense Strength—Employed in Many Useful Capacities in India.

RESPECTING the sagacity of the elephant, and regarding its intelligence and wisdom, countless stories have been related. The elephant is very faithful to his driver or keeper, and probably considers him as the leader of the herd. Dr. Hooker says that an elephant which he was riding in India became so deeply bogged that he remained stuck fast till next day, when he was extricated by men with ropes. Under such circumstances, elephants will seize with their trunks any object, dead or alive, to place under their knees to prevent them sinking deeper in the mud; and the driver was much concerned lest the animal should have seized Dr. Hooker and crushed him to death. But the driver himself ran no risk.

In India elephants are taught to perform many kinds of work. Their great strength and sagacity aid their owners even more effectively than the muscles of the horse or ox do the people of other countries. They seem to possess almost human intelligence and fully understand what is required of them. The illustration on the next page shows how an elephant sometimes carries fodder on his back and knows enough to

keep it in place by a rope held in his mouth.

One of the most interesting cases of the sagacity of an elephant is that related of the female elephant belonging to a menagerie, which in April, 1874, was attended for an illness at Tenbury, in England, by Mr. Turley, a local chemist. When Mr. Turley happened, in May, 1879, to be standing at his shop door as the menagerie passed through the town on a return visit, he was astonished to find that the elephant insisted on saluting him by placing her trunk in his hand, and by emitting a peculiar grunting noise.

INDIAN ELEPHANT TAKING HOME FODDER AND HOLDING IN HIS MOUTH THE ROPE THAT BINDS IT.

This was her recognition of Mr. Turley's attentions and kindness of five years before, that gentleman not having seen the animal once during the interval. As a further proof of the animal's accurate memory of all the circumstances of her former visit, it may be added that in May, 1881, the elephant again visited Tenbury. The following is the newspaper account—verified in a letter to me from Mr. Turley—of what took place:

Remarkable Sagacity of an Elephant.

"On Wednesday, Bostock's and Wombell's Menagerie visited Tenbury. This company came to this town some two years ago, when the elephant, journeying down Teme street, recognized Mr. Turley, chemist, who had cured her of a most dangerous attack of colic, brought on by drinking cold water. Strange to say, immediately the elephant caught sight of Mr. Turley, she began at once to evince her pleasure at seeing her preserver, and warmly embraced him by folding her trunk round his legs, rather to the dismay of her keeper, who asserted that had it been anyone but a friend she had so laid hold of she would have crushed his limbs to atoms instead of quietly pressing him."

On visiting the menagerie in the evening, the elephant again recognizing her medical friend, lifted him off his feet with her trunk, and "trumpted" in a very significant manner. At the same time she called his attention to her foreleg, with which Mr. Turley's previous treatment had had no concern. The keeper told Mr. Turley that, some months previously, the leg in question had been hurt, and that a veterinary surgeon had used a lancet to give the animal relief.

This surgical treatment exasperated the elephant so much that she struck at the veterinary surgeon with her trunk when he subsequently approached her. Her desire to draw Mr. Turley's attention to the foreleg was evidently an indication of her preference for, and her greater faith in, the treatment to which he had subjected his elephant patient. This shows a most remarkable degree of sagacity, many instances of which are on record.

The accompanying illustration shows the work done by elephants in the teak timber yards in Burmah, wherein they display an amount of intelligence which is often very surprising to a stranger. The most difficult work the elephant has to do is to pile the timber, the logs weighing generally about one ton, although some of them reach three tons in weight. An elephant will go on for hours disposing of log after log under the direction of his driver, who is mounted on his back,

ELEPHANTS OF BURMAH, INDIA, LAYING TIMBER.

Besides piling teak, the elephants drag the logs from place to place, and carry log ends on their tusks. These ends weigh from five to ten hundred weight each. Elephants do not commence working until they are about thirty years old. They then continue working for thirty to fifty years, although in India they live until they are 150 years old or more.

In India the domestic elephant performs more work than perhaps six horses.

He is generally fed with rice, raw or boiled,and mixed with water; and, to keep him in full vigor, he is said to require daily a hundred pounds weight of this food, besides fresh herbage to cool him; and he ought to be led to the water twice or thrice a day for the purpose of bathing. Elephants carry burdens on their bodies, on their necks, and even in their mouths, by giving them the end of a rope which they hold fast with their teeth.

Remember Injuries.

In India they are taught to do many kinds of work which they do quite as well as it could be done by men. Elephants very seldom forget an injury. They know when they are well treated, and when they are not they are apt to resent it. As they grow old they become dangerous and their keepers have to watch them closely.

In India these animals were formerly employed in the launching of ships. An elephant was directed to force a very large vessel into the water; but the work roved superior to his strength. His master, in a sarcastic tone, bade the keeper take away the lazy beast and bring another. The poor animal instantly repeated his efforts, fractured his skull and died on the spot

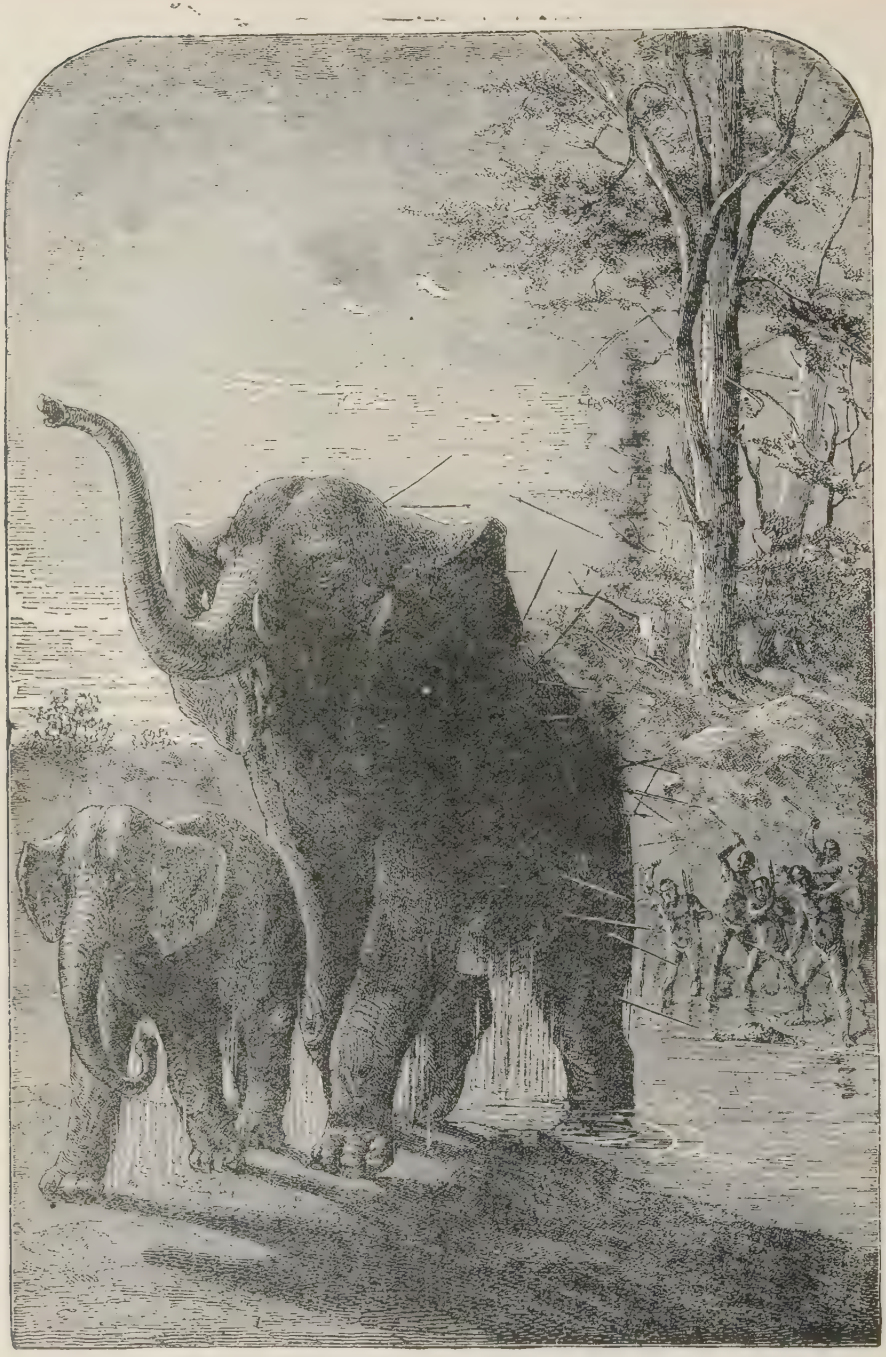
A story is related of an elephant having formed such an attachment for a very young child, that he was never happy but when the child was near him. The nurse frequently took it in its cradle, and placed it between his feet. This he at length became so much accustomed to, that he would never eat his food except it was present. When the child slept, he would drive off the flies with his probocis; and when it cried, would move the cradle backward and forward, and thus rock it again to sleep, thus acting the part of a solicitous mother.

A sentinel belonging to the present managerie at Paris, was always very careful in requesting the spectators not to give the elephants anything to eat. This conduct particularly displeased the female, who beheld him with a very unfavorable eye, and several times endeavored to correct his interference, by sprinkling his head with water from her trunk. One day, when several persons were collected to view these animals, a bystander offered the female a bit of bread.

Antics of an Elephant.

The sentinel perceived it; but the moment he opened his mouth to give his usual admonition, she, placing herself immediately before him, discharged in his face a considerable stream of water. A general laugh ensued, but the sentinel, having calmly wiped his face, stood a little to one side, and continued as vigilant as before. Soon after he found himself under the necessity of repeating his admonition to the spectators; but no sooner was this uttered than the female had laid hold of his musket, twirled it round with her trunk, trod it under her foot, and did not restore it till she had twisted it nearly in the form of a screw.

At Macassar, an elephant driver had a cocoanut given him,which, out of wantonness, he struck twice against his elephant's forehead, to break. The day following the animal saw some cocoanuts exposed in the street for sale; and taking one of them up with his trunk, beat it



FEMALE ELEPHANT PROTECTING HER YOUNG.

about the driver's head and killed him on the spot, for his insolent treatment.

An elephant that was exhibited in France some years ago, was remarked to

be peculiarly dexterous in the use of his trunk. With great ease he one day loosened the buckle of a large double leather strap, with which his leg was fastened; and, though the attendants had wrapped the buckle round with a small cord, and tied many knots on it the creature deliberately loosened the whole, without breaking either the cord or the strap.

One night, after having disengaged himself in this manner from his strap, he broke up the door of his lodge with such dexterity as not to awaken the keeper. Thence he went into several courts of the menagerie, forcing open doors, and throwing down the walls where the doors were too narrow for him to pass. In this manner he got access to the apartments of other animals; and so terrified them, that they fled into the most retired corners of the enclosure.

During one of the wars in India there was an opportunity of observing one of the elephants that had received a flesh wound from a cannon ball. After having been two or three times conducted to the hospital, he always used to go alone to have his wound dressed.

WONDERFUL PIECE OF ENGINEERING SKILL

EGYPT was noted for its great engineering works five to six thousand years ago, when King Mena turned the Nile out of its course and built the city of Memphis where the great river had flowed for ages. It was possibly a great irrigation scheme, really a "barrage" of those days. Engineers who could build the pyramids and transport the obelisks and colossi a thousand miles with ease could "bind the Nile," and did so.

To-day history repeats itself. The works at Assouan and Assiout vie with the labors of ancient Mena. The modern "binders of the Nile," are Mr. William Willcock's (the actual designer and projector of the Nile dams), and Sir Benjamin Baker, whose plans are carried out by Sir John Aird, Bart., as contractor for this great engineering work. The chief engineers, on whom fall all the risk and anxiety of the actual construction of the work, are Mr. Maurice Fitzmaurice and Mr. G. H. Stephens, typical specimens of the British engineer.

But another name deserves mention. The French barrage at Cairo was a failure. Sir John Fowler had strongly advised its being blown up at a cost of $500,000. But Sir Colin Scott Moncrieff offered, if given Mr. Willcock's aid, to save the condemned structure for $2,500,000. With Lord Cromer's aid the work was done. The revenue from the stored-up water repaid within two years the cost of the repairs of the French barrage. Then Sir W. Garstin and Major Hanbury Brown suggested that Mr. Willcocks should be employed to survey the whole Nile valley and suggest sites for other reservoirs to store up the waters of "High Nile" and thus double the

possible crops of the whole land of Egypt. Sir Colin Scott Moncrieff had left Egypt, but his mantle had fallen upon Mr. Willcocks, and he cheerfully accepted the gigantic task.

BIRD'S-EYE VIEW OF THE TWO GREAT DAMS ON THE RIVER NILE.

In three years he laid the plans of five or six reservoirs before the Egyptian authorities. How those plans fared, has oft been told—how the French would allow no money for the works from the Caisse de la Dette, and when the plans seemed destined to be "pigeon holed" Sir John Aird, Sir Benjamin Baker, and a strong syndicate undertook to build two great dams wherever pointed out. Then two of Mr. Willcock's sites were selected and the contracts let, thus working out the salvation of the ancient land of Egypt. All this regeneration of its finances and development of its resources cost its exchequer nothing.

The spectator is looking down the valley of the Nile. Immediately in front of him is the basin of the Assouan Reservoir showing the great dam as it appears when ready to hold up the water of the Nile. The foundations of the wall have been laid in a deep trench cut into the granite of the river bed. It was the presence of the granite at this spot and the converging of the hills that made the spot most favorable for the construction of a dam. The four locks will permit river traffic at any level of the water.

Two hundred and seventy miles away is the supplementary barrage at Assiout, which will also hold up the water at the point where the large canals commence. The water, flowing from the reservoir at Assouan, will take thirteen and a half days to reach the head of the Bahr Yusuf, which tradition states to have been constructed by Joseph (Yusuf being the local rendering of Joseph). Two hundred and twenty miles further lies the old barrage beyond Cairo, which has been doing its work well for years.

The construction of these dams, although not so huge a work as the great reservoir at Assouan, is yet a very wonderful piece of engineering skill. While the great reservoir has its foundations carried down to the solid granite rock, in the case of the Assiout reservoir the masonry is laid on the level bed of ancient Nile mud, here of great depth. By means of "aprons" and platforms of concrete above and below the weir, and needles of cast-iron piles driven deeply into the river's bed, a platform as hard and immovable as solid rock has been obtained.

This barrage will perform a great work, doubling the supply of the Bahr Yusuf and the great canals, new and old, and restoring many millions of acres of waste land to fertility. Deposits of ancient Nile mud will also be fertilized and rendered fit for agricultural purposes.

KIDNAPPING A MISSIONARY

ON September 3, 1901, Miss Ellen Stone, anAmerican lady missionary working in the Macedonian district of the Turkish Empire, was captured by a band of the brigands which infest the Balkan mountain ranges. Miss Stone was one of a party of sixteen, of whom fourteen were released after being "held up" by the brigands and relieved of their valuables. Those released consisted mainly of young native converts.

Miss Stone and Mrs. Tsilka, a graduate of the Presbyterian hospital of New York, but a Bulgarian citizen, so not under the protection of the United States, were carried away by the band. Miss Stone is a middle-aged lady, but Mrs. Tsilka being young and pretty, it was feared that she might be forced to marry one of the brigands as was the case with a young Frenchwoman captured some years ago. The same fate—or death—was also reported to have been threatened to Miss Stone if her ransom of $110,000 was not paid by October 8.

Large subscriptions were raised in America, but the whole amount was not realized by that date, and the fate of Miss Stone was left in painful suspense. Several letters were received from Miss Stone,

from which it appeared that she was fairly well treated, but that, owing to the brigands being hard pressed by the Turkish and Bulgarian soldiery, she and Mrs. Tsilka, who was expecting a child, had suffered considerably through being rushed from one hiding place to another.

THE KIDNAPPED MISSIONARIES, MISS STONE AND MADAM TSILKA, MEETING THEIR RESCUERS.

After the ransom had been paid the ladies were brought into the presence of the search party. On the left in the background is the Albanian who found the kidnapped party in the mountains at Gradachor.

Mr. C. M. Dickinson, United States Consul-General at Constantinople, endeavored to obtain Miss Stone's release, but for a long time without avail.

A correspondent in the brigand-haunted district wrote from Samokov that such was the disturbance created by the capture of Miss Stone that Prince Ferdinand brooded wearily over it as he sat in his solitary studio at Sofia, wondering what kind of people these Americans must be, seeing that their newspapers threatened to upset his "tin throne" merely because an elderly lady had been kidnapped. The Russian minister called the American diplomatic agent "an ass" because Consul-General Dickinson had higgled about the ransom. The American representative made a bosom friend of the consul from Belgrade because King Alexander's agent would conceal no secrets calculated to injure Bulgaria.

The Turkish Minister for Foreign

Affairs propounded a sum in the rule of three: Suppose Turkey has to pay 25,000 Turkish pounds for a woman of over fifty summers, a woman who has practically finished her life's work, and since according to Mahommedan ideas a man is worth four times as much as a woman, how much will Turkey have to pay for a young man kidnapped in the morning of a useful life?

party of her Bible teachers from Banisko to Djumia in Macedonia, when she was captured and carried off by the forty brigands. These "heroes of the hills" showed their chivalry by taking the two best horses belonging to the itinerant missionaries and mounting upon them Miss Stone and her captive companion, Mrs. Tsilka.

But when they made the women ford

RANSOM OF THE MISSIONARIES: MADAM TSILKA MEETING HER HUSBAND.

Miss Stone is better known throughout Bulgaria than in her native State of Massachusetts for she spent twenty-three years in "the peasant State." In fact, Samokov, where she was the directress of the female section of the American Institute, knows her better than Chelsea, Mass, where she was born.

Miss Stone is an excellent horsewoman. She was thus mounted, accompanying a

a river up to their waists the Robin Hoods of the Balkans showed that they are degenerate descendants of the chivalrous brigands who firmly believed if they molested a defenceless woman they should die in a Turkish prison. They acceded, however, to Miss Stone's request when they permitted her to take her Bible and umbrella with her.

A student of Samokov, who was of

Miss Stone's party and was released the day following the capture, tells a sad story of how the brigands robbed him of his savings. He had upon him the money he meant to pay for his next term's tuition. The brigands slowly went through his pockets and left him penniless. A fellow captive was more fortunate. He saved his watch by putting it in his hat. On the very first day of their capture the brigands showed the captives a touch of savagery by beating out the brains of a Turk with the butt ends of their guns.

The captives were not permitted to look into the faces of their captors, not because of the glory of their countenances, but because the brigands held revolvers to their heads and declared they must not do so. Miss Mary Haskell, a daughter of the Rev. Dr. Haskell and professor at the American Institute of Samokov, had a nocturnal experience with an emissary of Miss Stone's brigands which she will never forget. As she slept dreaming of the sad fate of her former teacher, she heard a decided knocking at her window. Quickly rising she saw a young man clothed in all the panoply of a brigand's armor. His words were few but pointed. They amounted to this :

"Give this letter to your father. Look not into my face or you are a dead woman. Say to your father that if he tells any one except those mentioned therein of the contents of this letter I will murder you all." The brigand touched his hat and rode away.

One of the most active and intelligent men who engaged in an effort to find Miss Stone is the Rev. Mr. Baird, purser of the American Institute at Samokov. He went alone to Djumia and made every effort to get into communication with the brigands.

Upwards of $70,000 were finally contributed to secure the release of the missionaries, and the brigands agreed to take it and set their captives free.

A correspondent who followed the American Mission in search of Miss Stone, thus describes the arrival of the ransom at Djuma-i-bala as follows:—"The Commandant and Saaddetdin Bey headed the procession on prancing Arab steeds, and they were followed by ten travel-stained troopers, a belt of cartridges round each man's waist, and a rifle laid across his saddle. Next came three carriages, ramshackle conveyances, all drawn by four horses.

Curious Cavalcade.

"The first was closed, but through the dusty windows we saw a pile of cases roped and wrapped in sacking. The second carriage contained the men who had brought it from Constantinople—the second Dragoman of the American Legation and the Deputy American Consul, with the Montenegrin Cavasse. The third carriage held Messrs. Guarjoulo and Peet, and beside the driver sat another Cavasse in a gorgeous blue and gold uniform. Captain Teffik Bey, the commander of the guard, rode alongside, and behind him fifteen more troopers on jaded steeds. As the procession entered the town the side alleys were packed with inquisitive women, their yashmaks drawn tight over their faces, their children clinging to the ample folds of their trousers.

"The soldiers walked alongside the cavalcade, talking to their comrades of the

escort until an officer ordered them back. At every door and window fez tassels trembled with excitement. The clatter of horses' feet and the clank of sabres filled the air as the procession groped its way through the dark and ill-paved streets of the bazaar."

The same correspondent who went with the party that rescued the missionaries related the following: "A dramatic incident occurred on the journey from Strumnitza to the railway after the ladies had been released. As our cavalcade reached the top of the Chipelli Pass Madame Tsilka's husband suddenly appeared. A scene of much emotion followed as he embraced the wife from whom he had so long been separated. He was soon introduced to his seven weeks' old daughter and carried her down the mountain path."

Miss Stone arrived in America about six months after her capture. Her coming was hailed joyfully by the multitude of persons who had become deeply interested in her misfortunes. In all religious assemblies she received an enthusiastic welcome.

In many of our cities she was greeted by large audiences, to whom she told in simple but most effective language the story of her hardships and subsequent release from the hands of the cut-throats, who had carried her away and held her captive in the hope of obtaining a large ransom for her release. With unaffected manner and graphic details she deeply interested people everywhere, who followed with unabated interest her vivid account of her experiences with the band of brigands.

ISLAND OF CUBA

Recovering from Spanish Oppression—Rich Tropical Products—The Public School System.

SINCE the accomplishment of the sole purpose of the war with Spain—the liberation of the people of Cuba from intolerable oppression, and the removal from the immediate vicinity of the United States territory of a continual source of disturbance—the promise of the Government at Washington to establish a free and independent republic on the island has been consistently and energetically pursued as expeditiously as the circumstances would warrant, culminating in the constitutional convention which met in Havana on November 5, 1900.

General Leonard Wood succeeded General John R. Brooke as Governor-General on December 20, 1899. From that date there was a steady diminution of the American garrisons and a rapid substitution of civil for military rule, notably marked by the general elections of June 15 and September 15, the former for municipal officers throughout the island and the latter for delegates to the constitutional convention called to assemble on November 5. Both elections were conducted without American officials, either military or civil, being at a single

polling place, and without any interference whatever on the part of the United States authorities. There was not a single disturbance at their election.

Important Results.

On January 12, General Wood issued an order to define the relations between the military and civil jurisdiction, in which the military, which had been practically supreme until that time, were forbidden to interfere in the conduct of civil affairs except in matters of sanitation. A summary of the progress made during the year is given by General Wood in the following brief abstract of his annual report: "The United States troops have not been used during the present year for the maintenance of order. The police work outside the principal municipalities is done by the rural guard, numbering about 1200 men. These men and their officers are all Cubans.

"Over 3000 public schools have been established, 3600 teachers are employed in them, and 200,000 children are in the schools. The largest number of pupils under the Spanish rule was between 26,000 and 30,000. The salaries paid the teachers exceed any paid in the United States in corresponding grades with the exception of three of our largest cities. The trip of the 1300 Cuban teachers to the United States in August, 1900, was most beneficial. All of the larger cities have undergone extensive street improvements, in fact the change in that particular since the American occupation has been most remarkable. Travelers can go from one end of Cuba to the other without being solicited by beggars, and hunger is absolutely a thing of the past. This has come about since the American occupation of Cuba.

"A thoroughly efficient mail service has been provided and is being conducted with efficiency and economy. Public works, involving millions of dollars, have been taken up and completed. Between 600 and 700 miles of first-class roads have been built and many hundreds of miles have been put in repair and made passable. A complete overland telegraph system has been put in operation through all the provinces. The financial condition of the country is excellent. The government is entirely self-supporting, and the treasury has an unincumbered balance of $1,500,000. Municipalities are gradually assuming their financial obligations and responsibilities, and relieving the State of the care and expense for police, sanitation, etc., which will result in more money being available for public works of general utility.

Prisons Improved.

"In January and February, 1900, all the prisons were overhauled and repaired and their sanitary conditions vastly improved. Hundreds of prisoners detained for long periods awaiting trial were released after being held as long as they would have been imprisoned if found guilty of the charges for which they were arrested. Justice has been stimulated by every means."

On May 20, 1902, General Wood, acting for the United States, formally transferred Cuba to the Cuban Government under President Palma. The new government received from many sources hearty congratulations and best wishes for a peaceful and prosperous career.

HAWAIIAN ISLANDS

Their Population and Territory—Products and Industries—Character of Inhabitants.

HAWAII was annexed to the United States by joint resolution of Congress, July 6, 1898. A bill to create Hawaii a territory of the United States was passed by Congress and approved April 30, 1900.

The area of the several islands of the Hawaiian group is as follows: Hawaii, 4,210 square miles; Maui, 760; Oahu, 600; Kauai, 590; Molokai, 270; Lanai, 150; Niihau. 97; Kahoolawe, 63. Total, 6,740 square miles. At the time of the discovery of the islands by Captain Cook in 1778 the native population was about 200,000. This has steadily decreased, so that at the last census the natives numbered but 31,019, which was less than that of the Japanese and Chinese immigrants settled in the islands.

The first United States census of the islands was taken in 1900, with the following result: Hawaii Island, 46,843; Kauai Island, 20,562; Niihau Island, 172; Maui Island, 25,416; Molokai Island and Lanai Island, 2,504; Oahu Island, 58,504. Total of the territory, 154,001. The population of the city of Honolulu is 39,306.

Nearly all the natives are Christians. In 1896 there were 23,773 Protestants, 26,362 Roman Catholics, 4,886 Mormons, 44,306 Buddhists, etc., and 10,192 not described.

There are 71 miles of railroad and about 250 miles of telegraph in the islands. Honolulu, the capital, with a population of 28,061, is lighted by electricity and has most of the local features of an enterprising American city. The bulk of the business is done by Americans and Europeans.

The new Territorial Government was inaugurated at Honolulu June 14, 1900. The inauguration of Governor Dole took place on the steps of the capitol at 10 o'clock A. M. Prayer was offered by the Rev. E. S. Timoteo, pastor of Kaumakapili church. Governor Dole's commission was then read by Mr. Smith, the retiring Minister of Foreign Affairs, and the oath of office was administered by Justice Frear, of the Supreme Court under the Republic and Chief Justice of the Territory under the new regime. After the reading of the Governor's inaugural address, there was a review of the National Guard of Hawaii, and then a reception to the public in the hall of the house of representatives, the old throne room of the palace. The reception was attended by several thousand persons, representing every race and station. The ceremonies ended in the evening with a ball.

The chief products of the Hawaiian Islands are sugar, coffee and rice. The soil is better adapted to the sugar cane than is that of the West Indies.

PORTO RICO

A Possession of the United States—Number of Population—Mineral and Vegetable Products.

THE island of Porto Rico, over which the flag of the United States was raised in token of formal possession, on October 18, 1898, is the most eastern of the Greater Antilles, in the West Indies, and is separated on the east from the Danish Island of St. Thomas by a distance of about fifty miles, and from Hayti on the west by the Mona passage seventy miles wide. Distances from San Juan, the capital, to important points are as follows: New York, 1720 miles; Charleston, S. C., 1200 miles; Key West, Fla., 1050 miles; Havana, 1000 miles.

The island is a parallelogram in general outline, 108 miles from the east to the west and from 37 to 43 miles across, the area being about 3600 square miles, or somewhat less than half that of the State of New Jersey (Delaware has 2050 square miles, and Connecticut 4990 square miles). The population according to an enumeration made in 1887, was 798,565, of whom 474,933 were whites, 246,647 mulattoes, and 76,905 negroes. An enumeration taken by the United States Government in 1900 showed a population of 953,243.

Porto Rico is unusually fertile, and its dominant industries are agriculture and lumbering. In elevated regions the vegetation of the temperate zone is not unknown. There are more than 500 varieties of trees found in the forests, and the plains are full of palm, orange and other trees.

The principal crops are sugar, coffee, tobacco, cotton and maize, but bananas, rice, pineapples and many other fruits are important products. The largest article of export from Porto Rico is coffee, which is over 63 per cent. of the whole. The next largest is sugar, 28 per cent. The other exports in order of amount are tobacco, honey, molasses, cattle, timber and hides.

The principal minerals found in Porto Rico are gold, carbonates, and sulphides of copper, and magnetic oxide of iron in large quantities. Lignite is found at Utuado and Moca, and also yellow amber. A large variety of marbles, limestones and other building stones are deposited on the island, but these resources are very undeveloped. There are salt works at Guanica and Salinac on the south coast and at Cape Rojo on the west, and these constitute the principal mineral industry.

There are 137 miles of railway, with many miles under construction, and 470 miles of telegraph lines. These connect the capital with the principal ports south and west. Submarine cables run from San Juan to St. Thomas and Jamaica. The principal cities are Ponce, 27,952 inhabitants; Arecibo, with 30,000, and San Juan, the capital, with 32,048.

An act providing for a civil government for Porto Rico was passed by the Fifty-sixth Congress, and received the assent of the President April 12, 1900.

Island of Guam.

The island of Guam, the largest of the Marianne or Ladrone Archipelago, was ceded by Spain to the United States by Article 2 of the Treaty of Peace, concluded at Paris, December 10, 1898. It lies in a direct line from San Francisco to the southern part of the Philippines, and is 5,200 miles from San Francisco, and 900 miles from Manila. It is about 32 miles long and 100 miles in circumference, and has a population of about 8,661, of whom 5,249 are in Agana, the capital.

The inhabitants are mostly immigrants or descendants of immigrants from the Philippines, the original race of the Ladrone Islands being extinct. The prevailing language is Spanish. Nine-tenths of the islanders can read and write. The island is thickly wooded, well watered and fertile, and possesses an excellent harbor.

Commander Taussig, of the United States gunboat "Bennington," took possession of the island and raised the United States flag over Fort Santa Cruz on February 1, 1899.

The United States flag was hoisted over Wake Island in January, 1899, by Commander Taussig, of the "Bennington," while proceeding to Guam. It is a small island in the direct route from Hawaii to Hong Kong, about 2,000 miles from the first, and 3,000 miles from the second. It is not a large, but is a valuable, possession of the United States.

Island of Tutuila.

Tutuila, the Samoan island which, with its attendant islets, became a possession of the United States by virtue of the tripartite treaty with Great Britain and Germany in 1899, covers according to the Bureau of Statistics of the Treasury Department, fifty-four square miles, and has 4,000 inhabitants. It possesses the most valuable island harbor, Pago Pago, in the South Pacific, and perhaps in the entire Pacific Ocean. Commercially the island is unimportant at present, but is extremely valuable in its relations to the commerce of any nation desiring to cultivate transpacific commerce.

Ex-Chief Justice Chambers, of Samoa, says of Pago-Pago that "The harbor could hold the entire naval force of the United States, and is so perfectly arranged that only two vessels can enter at the same time. The coaling station, being surrounded by high bluffs, cannot be reached by shells from outside."

Samoan Islands.

The Samoan Islands in the South Pacific are fourteen in number, and lie in a direct line drawn from San Francisco to Auckland, New Zealand. They are 4,000 miles from San Francisco, 2,200 miles from Hawaii, 1,900 miles from Auckland, 2,000 miles from Sidney, and 4,200 miles from Manila.. The inhabitants are native Polynesians and Christians of different denominations.

The native inhabitants of these islands are composed of better stock, more easily instructed, restrained and inspired to gain knowledge, and also to accept the teachings of Christianity, than many of the South Sea islanders.

THE PHILIPPINE ISLANDS

THE Philippine group, lying off the southern coast of Asia, number about two thousand islands, great and small, in a land and sea area of 1,200 miles of latitude and 2,400 miles of longitude. The actual land area is about 140,000 miles. The six New England States, New York, and New Jersey have about an equivalent area.

The island of Luzon, on which the capital city (Manila) is situated, is the largest member of the group, being about the size of the State of New York; Mindanao is nearly as large, but its population is very much smaller. The latest estimates of areas of the largest islands are as follows : Luzon, 44,400 ; Mindanao, 34,000; Samar, 4,800 ; Panay, 4,700 ; Mindoro, 4,000 ; Leyte, 3,800 ; Negros, 3,300 ; Cebu, 2,400.

The estimates of population vary from 7,500,000 to 10,000,000. A conservative estimate is 8,000,000. The late Spanish masters had never caused a census to be taken, and, indeed, some parts of the islands are yet unexplored and inhabited by tribes nearly savage. Racially the inhabitants are principally Malays. The country has been in the possession of Spain since 1565, and the religion introduced by the proprietors has long been that of the natives. The church has been a strong ruling power and the priesthood numerous. There are thirty different races, all speaking a different dialect.

The following memoranda was prepared by Major-General F. V. Greene for the Government :

Climate.

The climate is one of the best known in the tropics. The thermometer during July and August rarely goes below 79° or above 85°. The extreme ranges in a year are said to be 61° and 97°, and the annual mean 81°. There are three well-marked seasons, temperate and dry from November to February, hot and dry from March to May, and temperate and wet from June to October. The rainy season reaches its maximum in July and August, when the rains are constant and very heavy. The total rainfall has been as high as 114 inches in one year.

Yellow fever appears to be unknown. The diseases most fatal among the natives are cholera and smallpox, both of which are brought from China. Low malarial fever is brought on by sleeping on the ground or being chilled by remaining without exercise in wet clothes ; and diarrhœa is produced by drinking bad water or eating excessive quantities of fruit. Almost all of these diseases are very preventable by proper precautions even by troops in campaign. The sick-

ness in our troops was very small, much less than in the cold fogs at camp in San Francisco.

Mineral Wealth.

Very little is known concerning the mineral wealth of the islands. It is stated that there are deposits of coal, petroleum, iron, lead, sulphur, copper, and gold in the various islands, but little or nothing has been done to develop them. A few concessions have been granted for working mines, but the output is not large. The gold is reported on Luzon, coal and petroleum on Cebu and Iloilo, and sulphur on Leyte.

Agriculture.

Although agriculture is the chief occupation of the Filipinos, yet only one-ninth of the surface is under cultivation. The soil is very fertile, and even after deducting the mountain areas it is probable that the area of cultivation can be very largely extended and that the islands can support a population equal to that of Japan (42,000,000).

The chief products are rice, corn, hemp, sugar, tobacco, cocoanuts, and cacao. Coffee and cotton were formerly produced in large quantities—the former for export and the latter for home consumption; but the coffee plant has been almost exterminated by insects and the home-made cotton cloths have been driven out by the competition of those imported from England. The rice and corn are principally produced in Luzon and Mindoro and are consumed in the islands. The rice crop is about 765,000 tons annually, and forms an important industry.

Acquisition of Territory by the United States.

The original territory of the United States comprised 827,844 square miles; transferred from Great Britain by Treaty of Paris, September 3, 1783. The present total area of the United States (main body) is 3,090,777 square miles; total area of outlying territory, 747,733 square miles; aggregate 3,838,510 square miles.

Lousianana Territory (1,171,931 square miles)—Purchased from France, by treaty, April 30, 1803, for $15,000,000.

Florida Provinces (59,268 square miles)—Purchased from Spain, by treaty, February 22, 1819, for $5,000,000.

Oregon (291,000 square miles) by discovery, 1792; exploration, 1805–'06; settlement, 1811; and treaties with France (1803), Spain (1819), Russia (1825) and England (1846).

Texas Annexation (376,133 square miles)—By convention with Texas Republic, March, 2, 1845, and payment of $10,000,000.

Mexican Cession (first, 545,783 square miles)—By conquest and purchase from Mexico for $15,000,000, Treaty of Guadalupe Hidalgo, February 2, 1848. Second cession (45,535 square miles)—Purchased from Mexico for $10,000 by Gadsden Treaty, December 30, 1853.

Alaska (577,390 square miles)—Purchased from Russia, March 30, 1867, for $7,200,000.

Hawaii (6,740 square miles)—Annexed by joint resolution of Congress, July 6, 1898.

Spanish Cessions.—Porto Rico, 3,600 square miles; Philippines, 140,000 square miles; Guam, 100 square miles. By treaty of Paris, December 10, 1898, and payment to Spain of $20,000,000.

LIGHT AS A HEALER

Remarkable Cures Performed by the Rays of the Sun—New Factor in Medical Science.

THAT light has a beneficial effect on the human body in certain conditions has long been a matter of common knowledge, or in one form or another it has for centuries been used in the treatment of disease by individual practitioners. In the fourteenth century John of Gaddesden cured a Prince of Wales of smallpox by hanging red curtains about his bed, and thus keeping him exposed to the influence of red rays of light. This practice was successfully revived a few years ago by Professor Niel R. Finsen, of Copenhagen.

More recently, the same physician was led to try the effects of the direct application of concentrated light to the skin, and with results so remarkable that they have attracted the attention of the medical profession throughout the world. By this method he has succeeded in curing lupus, a disease of tuberculous nature which causes hideous deformity, and which has hitherto been very refractory even to energetic surgical treatment. Public interest in the Danish physician's discovery was excited in England by the fact that the initiative in making the treatment available for poor sufferers was taken by Queen Alexandra.

Her Majesty, as is well known, is in the habit of paying unostentatious visits to the London hospitals, where the sick, whose sufferings she soothes, often do not know who the ministering angel is till she is gone. In the course of a visit to the London Hospital, the Queen expressed a wish that the light treatment should be tried in the London Hospital. Her Majesty showed herself fully acquainted with the principles and details of the method, which she explained to the authorities of the hospital.

She further most generously offered to give the hospital four lamps of the kind used in carrying out the treatment, at a cost of nearly $500. The offer was gratefully accepted, and two nurses were at once sent to Copenhagen to learn the details of the method.

Dr. Stephen Mackenzie, senior physician to the hospital, and Dr. Sequeira, another member of the staff, also went to see for themselves the results of the treatment. In a short time the installation in the London Hospital was complete, and a department for the systematic carrying out of the treatment established.

The light treatment is based on the three principles:—

1. That the chemical rays of the sun or of the electric light can produce an inflammation of the skin.

2. That they can produce an effect through the skin.

3. That they can kill microbes on, in, or close under the skin.

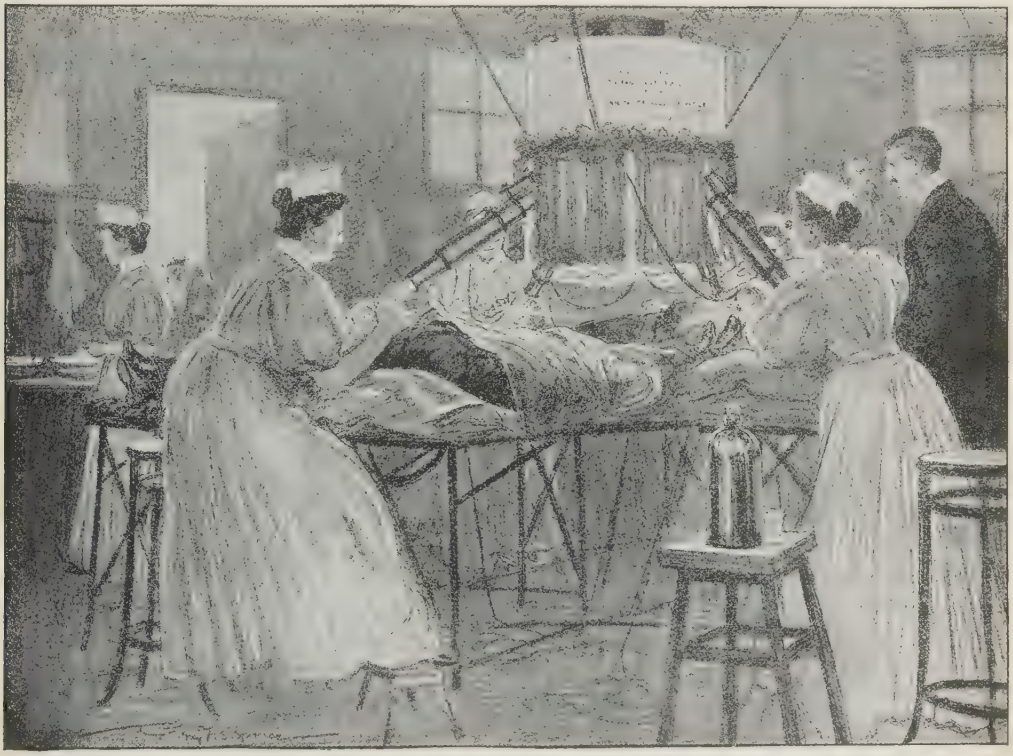
In a sunbeam, as everyone knows, there are, besides heat rays, chemical rays of various colors. It would seem natural to attribute sunburn to the heat rays, but as long ago as 1859, Charcot held that it was due to the ultra-violet and violet chemical rays of light. This view has

since been confirmed by the researches of Wildmark and Finsen. That sunlight could kill microbes was first proved by Downes and Blunt, and this bactericidal power was shown to depend especially on the blue, violet, and ultra-violet rays.

Bie, of Copenhagen, and others have proved that a like effect can be produced by means of electric light. But even the fiercest glare of summer sunshine has too little germ-killing potency to be of any practical use in the treatment of skin diseases caused by microbes.

Finsen, therefore, conceived the idea of eliminating the heat rays and concentrating the bactericidal chemical rays in such a manner as to bring the largest possible number of blue, violet and ultra-violet rays to bear on the micro-organisms in the diseased portions of the skin. In his apparatus the power of water is utilized to absorb the ultra-red, or most caloric rays, and that of blue substances dissolved in it to asorb many of the red and yellow rays.

In dealing with sunlight, he uses a hollow plano-convex lens, 8 to 16 inches in diameter, containing a bright blue ammoniacal solution of copper sulphate. But the light thus treated is still too warm to be used on the human skin ; an additional cooling mechanism is therefore required. This consists of a hollow lens, similar in shape to that just described, but only about an inch in diameter ; it is



THE NEW LIGHT CURE—HEALING MALIGNANT GROWTHS ON THE SURFACE OF THE BODY BY CHEMICAL RAYS OF THE SUN.

provided with inflow and outflow tubes, through which water is kept constantly circulating.

The divergent rays from the lamp must first be rendered parallel before being converged, concentrated in a focus, and cooled. The apparatus used for this purpose is a telescope, the large end of which is placed next to the lamp, having lenses made of quartz or rock crystal, which itself can absorb heat rays, and between two such lenses a length of tube filled with distilled water, around which cold water is made to circulate in a sort of water-jacket that absorbs still more of the caloric rays.

The accompanying illustration shows the manner in which the treatment is carried out. The patients recline on light movable couches. The nurses who administer the treatment wear washable overalls and work with sterilized uncovered arms; they wear dark spectacles to protect their eyes.

Only a small area of skin can be treated at a time, and this has first to be made bloodless by pressure, so as to allow the light to penetrate its thickness more readily, and then cleansed. Then a spot of light about the size of a ten-cent piece is allowed to fall on the selected portion of skin for an hour, after which a cooling ointment is applied, and the treatment is over for the day. The installation cost the London Hospital over $5000, and no fewer than twelve nurses and two sisters are required to give their whole time to the work. In Denmark the state grants a subsidy to Dr. Finsen's "Lysinstitut."

DIVING STAGS AND HORSES

Animals that Leap from a Height of 35 Feet—Wonderful Feats.

MANY trick horses have been exhibited in this country, that from a certain height leap into water. It takes years of training for a horse to accomplish this feat, but the same trick has been done by two stags belonging to Albert Schumann, a circus manager.

Mr. Schumann has achieved fame as a trainer of animals, especially horses, creating a sensation wherever he exhibited them, but his latest achievement in getting these stags, who from nature are timid and shy under such control that they jump into space, has made a furore wherever they have been seen. In the course of training these animals, force or rigorous treatment would bring absolutely no result and Mr. Schumann had to practically invent his own method of training.

Of course it was necessary to commence with very young deer, because a full grown stag could hardly have been managed. The trick is done as follows: A young stag is coaxed into a kind of

elevator car, which has a side door; it is then, by means of a pulley, carried up into the car, a distant of 35 feet when, through a mechanical device, this side door opens and the stag at a command given by its trainer leaps into a pond or tank of water. It is then followed by another one.

MARVELLOUS LEAP OF THE DIVING STAG.

Not a trace of fear do these animals display. When the door opens, they seem to measure with their eyes, the distance beneath them and then they slowly bend their knees for a spring and gracefully jump into the water, after which they swim across, climb out of the water and mirthfully run out of the circus to their stable.

It has been questioned whether these creatures in their freedom can jump any distance beneath them, but it is said by experienced gunners and hunters, that although they are known to leap considerable distances upwards to cliffs and also on level ground, they have never been known, even though pursued, to spring from a cliff into space beneath them.

An account of the entertainment constantly furnished at the Crystal Palace, near London, says the most novel performance is, beyond question, that of the wonderful "Diving Horses." They are a pair of beautiful and high-spirited animals who go through their performance with every appearance of pride and pleasure; and, according to report, their amphibious habits have given them a physical stamina vastly superior to that

of their fellows. It is stated that during their passage from America they alone survived the voyage, while twenty other animals died from its effects. King and Queen, as they are aptly named, safely reached the scene of their labors. In the centre transept of the Palace a platform is erected at a great height, beneath which is a huge tank sunk in the floor.

A Headlong Plunge.

The animals mount the platform without compulsion or even guidance, and no word of command is employed to prompt them to their headlong plunge. In fact King and Queen quite intelligently appreciate the requirements of their feat. Their determination to succeed is evinced by the fact that if on any occasion they do not dive to their own satisfaction, they again mount the platform and repeat the act, doubtless with an expert perception of the causes of their failure, and a determination to avoid them at the second attempt. They have been known to do this twice, independently of any compulsion, save the promptings of their artistic conscience.

One would suppose the training of diving horses to be but a record of persistent cruelty on the part of their masters. In the case of King and Queen, however, nothing but a little innocent trickery has been employed. When foals they were placed in a field, separated from that in which the mare was grazing by a hedge and a deep river. In their anxiety to reach her on one occasion the foals jumped the hedge, and successfully swam across the stream. So easy did the feat prove that the interesting pair decided that while there was any water in the neighborhood, they would not remain in the field.

To jump into the river and swim across it became in consequence an item in their daily routine. The owner, instead of curbing this unusual trait in the character of his horses, encouraged it. He placed greater obstacles in their way, and contrived diving positions. In fact, he provided the facilities and they trained themselves, the whole process being one of sheer enjoyment, which it has continued to be up to the present time.

The diving horses are an American achievement; and Coney Island, New York, and Westside Park, Philadelphia, were for some time the scene of their performances. The beauty, novelty, and daring of their feats have excited universal admiration.

Sagacity of the Horse.

This animal is proverbially intelligent. It is a good sign for a horse to carry one ear forward and the other backward when on a journey, because this stretching of the ears in contrary directions shows that he is attentive to everything that is taking place around him. Few horses sleep without pointing their ears as above, so as to receive notice of the approach of objects in every direction. When horses or mules march in company at night, those in the front direct their ears forward, those in the rear direct them backward, and those in the center turn them laterally or across; the whole troop seeming thus to be actuated by one feeling, which watches the general safety.

Most persons will consider that this is proof of intelligence, and that some horses know almost as much as human beings.

THE LONGEST RAILROAD

Completion of the Trans-Siberian Railway Opens Up the Vast Plains of Asia to Immigration and Civilization.

AFTER eleven years of unremitting labor, the Russian railway builders have completed the Trans-Siberian Railway. It may be remembered that the difficulties of construction along the coast surveyed around the southern shore of Lake Baikal, in Southeastern Siberia, were so great that it was decided to ferry trains across the lake, but almost as soon as the road was opened from European Russia to the lake the traffic became so heavy that the $1,000,000 ferry could not accommodate it.

The present Czar of Russia has been intimately associated with the enterprise from the beginning. In 1891 he traveled around the world, having, in Japan, the serious misadventure with a native fanatic that came so near putting an end tc his career. Nicholas traversed Siberia, and personally filled a wheelbarrow with dirt and dumped the soil on an embankment to make a formal beginning of the work of building the great railway.

This was on May 9, 1891. The road constructed is the greatest in the world. With its branches it covers 5542 miles.

M. de Wollant, the Russian Charge d'Affaires at Washington, confirmed the report from St. Petersburg, that Russia had practically completed her Trans-Siberian railroad.

The total cost of the Siberian railway, constructed by Russians and with Russian money—with all its branches and auxiliary undertakings—amounts to $390,000,000, of which $350,000,000 was expended by 1900.

The construction of the railway began in the reign of Emperor Alexander III., and the first stone of this great undertaking was laid at Vladivostock,as already stated, by Emperor Nicholas, then the heir apparent. In the interests of transport and with the object of rendering the stupendous undertaking as inexpensive as possible, the shortest and most direct route was selected, traversing the most fruitful and comparatively populous belt of country, the granary of Siberia. The Siberian railway was begun at both ends, its western terminus being Tcheliabinsk, the last station of the Samara-Zlatoust railway and a district town in the province of Orenburg.

By 1900 3,375 miles of line were laid down, making 375 miles a year. Such results must be considered as very favorable, especially taking into account, first, the difficulty of laying the permanent way in a country so intersected by rivers, and so liable to inundation, and, secondly, the great number of large rivers to be crossed by the Siberian railway, more than thirty miles of bridges being required for this purpose.

The longest of these bridges is that over the River Yenisei, it being 2,940 feet long, with spans measuring 490 feet. In rapidity of construction the Siberian railway is unequalled, and excels the Canadian railway (2,920 miles), which has so much in common with it, and which took ten years to build.

A New "Open Door."

Direct steam communication is now possible between the European railway net and Vladivostock. From the very first the immediate results of working the Siberian railway, as shown by the extent of passenger and goods traffic, exceeded all previous expectations. For three months of 1895 and the years 1896, 1897, 1898 and 1899, there were carried on the southern and central Siberian sections 3,352,000 passengers and 2,011,000 tons of freight.

By the will of its imperial originator the construction of the Siberian railway was placed in close connection with the auxiliary undertakings of that railway, the promotion of the colonization and industrial development of Siberia.

The Siberian railway opened a door into Siberia, through which a broad stream of emigration poured. The work of emigration has been placed on a proper footing and has become strictly regulated, in accordance with the great importance of this phenomenon in national life, which in Russia forms the last stage of the natural historic process of distributing the population over the country.

On exhausting the suitable land in the immediate vicinity of the railway colonization was extended, on the one hand, to the nothern forestry (forest) region of Siberia, and, on the other hand, to the southern steppe regions, comparatively remote from the railway.

While the material wants of the emigrants to Siberia have been provided for, their spiritual requirements have not been forgotten. On the initiative of Emperor Nicholas II. a special fund, formed by private donations and subsidized by the Siberian Railway Committee, was established for the erection of churches and schools in the Siberian settlements. With the money collected one hundred churches and seventy-three schools have already been built, and other churches and schools will follow.

Owing to the construction of the Siberian railway the number of emigrants has increased considerably, and has reached a formerly unheard of high figure. Since the institution of the railway committee 996,000 persons have emigrated to Siberia, which makes an average of about one hundred and forty-two thousand a year.

New Commercial Port.

In order to regulate the trade with the countries of the Far East—China and Japan—the railway committee has constructed a commercial port at Vladivostock; there is a strong ice breaking steamer for use in winter, and the port is calculated for an annual turnover of 160,000 tons of goods. The Russo-Chinese Bank has likewise been established.

To facilitate the transport of building materials for the Eastern Chinese railway, as well as to extend Russian export trade in Eastern Asia, the above mentioned

railway company has organized a regular service of steamers along the Pacific and the river Sungari, which flows through the most thickly populated and industrial part of Manchuria. On the shores of the unfrozen Yellow Sea and Ta-Lien-Wan, one of the termini of the great transcontinental railway, by the orders of the Emperor Nicholas II., the port and town of Dalniy have been established. Dalniy is a free port.

A Vast Country.

However large the cost of the railway may be, it is insignificant in comparison with the commercial and strategic advantages held out to Russia by the exploitation of the shortest railway route between the Atlantic and the Pacific, in conjunction with the stimulation of the rich productive powers of a vast country like Siberia, and the development of Russia's commercial intercourse with the countries of Eastern Asia.

The dream of travelers to make the journey from Paris to Pekin entirely by rail is now a reality. The Londoner who wanted to reach Shanghai, the commercial capital of the East, had hitherto to follow a roundabout, zigzag route by way of the Mediterranean, the Suez Canal, then through long sweeps of ocean to Colombo, Singapore, and Hong-Kong. The time occupied in this voyage was something approaching six weeks, and the cost from $325 to $475.

Now, if he is in a hurry, the Londoner skips over to the Continent, catches the Nord express to Moscow, jumps into the Siberian express to Irkutsk, and all being well, he should reach his destination on the twenty-first day after wiping the fog of London from his eyes. He will find the first-class fare from London to Shanghai by the overland route to be $160; if he travels second-class—and second-class across Russia is different from the first only in small detail—the cost will be $120; whereas, if money is a consideration and he desires to travel as cheaply as possible, he may go third-class, and his fare for the eight thousand miles will be $67.50.

The great Trans-Siberian line, spreading across the continent of Asia, may now be described as complete. It is, in itself, over five thousand miles long, and every rail has been put down and every bridge built in eleven years. Including thirty miles of bridges, huge massive iron structures many of them, the line through Central Siberia was laid at the rate of rather over a mile a day, while the Trans-Manchurian section has been thrown down at the extraordinary speed of three miles a day.

Fascinatiug Ride.

When first you set out on this long journey over thousands of miles of plain, with not a hump that would serve as a teeing ground for golf, and then go through thousands of miles of forest, you are prepared to be bored. But the boredom has hardly time to get hold of you before you begin to be fascinated. The train trundles on for eight level days between Moscow, with its Byzantine and Oriental architecture, to the bustling city of Irkutsk, in Eastern Siberia, with its broad streets and big hotels and electric lights, a town in exterior rather like a Western American place, but in gaiety and wickedness doing its best to live

up to its reputation of being the "Paris of Siberia."

During those eight days you have only to spend half a day in the observation-car, and watch the two ribbons of steel spinning, as it were, out from beneath you, hour after hour, never ceasing, across a great slice of the world, bare and featureless in the matter of scenery, to be captivated by the wonder of the thing, the marvel, indeed, that this line should set out from Moscow and safely reach Vladivostock without losing itself. The longer you are traveling, the more you become impressed.

Eighth Wonder of the World.

The Trans-Siberian railway is the eighth wonder of the world, and in the days to come, when the folks of Mars visit the Earth on a personally conducted tour, we may well fancy it will be this railway which will be shown as the greatest thing man has ever done.

An express runs out of Moscow twice a week. The engines are colossal, most of them manufactured by Baldwins of Philadelphia. There is one first-class car, two second-class cars, a dining-car, a car for cooking and conveyance of baggage, and, finally, a car with a bathroom, a dark-room, with all photographic appliances, a gymnasium where you may exercise and keep yourself in condition, and a section, all windows, for observation. The dining-car is large and roomy, with movable tables and chairs; and there is a piano, which is handy, because concerts are arranged among the passengers; and there is also a library, where you will find Charles Dicken's novels in Russian.

In the centre of the first-class car is an open lounge, where smoking is allowed; while at one end of the car is a ladies' boudoir. Each coupe is large and comfortable, carpeted, has a table and chair, and a movable electric reading-lamp. Each night the attendant makes a comfortable bed, a hundred times preferable to the American plan of undressing behind a screen, and being bumped by everybody passing along the gangway.

A ring at one electric bell will bring the attendant, who is obliging, as attendants always are—scenting the gift of roubles at the journey's end. A ring at another electric bell will bring a man from the buffet. While you are having breakfast, your coupe will be placed in order. Though the snow be lying thick outside, and the thermometer twenty degrees below zero, the carriages, by means of hot-air pipes, are kept at a cosy warmth. You will probably notice the cars have a refreshing scent; two or three times a day the attendant sprays the train with soft perfume. Under such conditions travel loses its terror.

Journey Seems Short.

Indeed, what with reading and conversation, music and smoking, dining and sleeping, each day slips by very easily, and when the long journey is over you exclaim, "Why, it doesn't seem to have been a quarter of the time." That, at any rate, is how it impressed the writer, who crossed and recrossed Siberia twice in the course of three months.

The thing in which the Siberian railway is lacking is speed. The Russians are a leisurely people, and their trains are leisurely also. At the outside the speed across Siberia is never more than thirty

miles an hour, and often it is as low as ten. A good deal of this, however, is due to the unsatisfactory ballasting of the line. The original idea in laying it was for military purposes, in order that large bodies of troops might be hurried to the Far East in war time.

Towns Springing Up.

To the surprise of everyone, a great commercial traffic has begun, and towns are springing up all along the line, as they do along the Canadian-Pacific route. Heavy goods trains are always to be seen at the wayside stations, where trains pass one another; for, of course, the Trans-Siberian is only a single line. There is a post train going each way every day, and also local trains. It was thought to be a daring experiment when one express train a week for Irkutsk was put on. Now there are two express trains each way every week, and you must book your place long ahead to be sure of getting a berth.

The line is lightly ballasted, and the rails of absurdly light weight. It is therefore subjected to a traffic never contemplated. Fast traveling would be dangerous. Within three years, when the trains can really travel express and the long delays at the railway stations are abolished, the journey between Paris and Pekin should be done in fourteen or sixteen days.

The gauge being broad and the carriages big and heavy, the train glides along with hardly a jolt. There is no inconvenience in writing, and each morning one can shave without mishap.

The long halts at the railway stations have been mentioned. In a way, these are an advantage, for passengers can get out and have a walk. It is possible, also to dine at the station buffet. No country in the world has such fine railway buffets as are to be found in Russia. At the smallest stations there are always tea and soup, and what may best be described as hot mincemeat dumplings. But at fair-sized stations, even in places four thousand miles east of Moscow, there are large dining halls, with well-appointed table decorations, smart waiters, and men cooks in white blouses and white caps. There is beer, or Crimean wine, or French champagne.

There is always a cheap buffet for the peasants—and the price of everything is fixed by the Ministry of Ways—and on the platform is a huge steaming samovar where anyone may obtain hot water to make the ever-welcome and delicious tea

A marked similarity may be noticed in the designs of the stations—all yellow or grey, with green roofs. Now and then there is a tendency towards the florid. All sorts of curious wooden designs are put up, and although Siberia is not a favorable country for flower-culture, brave attempts are often made to rear bright blooms.

If you traverse Siberia in winter it will be wrapped in snow, dreary, and bleak. But in the summer, although devoid of majestic scenery, it is warm, the land is radiant with flowers, and the traveler decides that it is not by any means the dreadful country which popular fiction declares. Siberia undoubtedly has a great agricultural future, and the building of the Trans-Siberian railway has opened the eyes of the world to the commercial possibilities of this Canada of the East.

COUNT ROCHAMBEAU

Story of the Great General Who Led the French Army and Helped to Win American Independence.

JEAN BAPTISTE was born on July 1, 1725, the year that the young King Louis XV. was married to Maria, of Poland. The Comte, his father, was Governor of Vendome and Lieutenant of the Marshals of France. His mother was governess of the children of the Duke of Orleans, the king's brother. As he was only a second son, and in his boyhood weak of body, Jean Baptiste was marked out by his parents for a Church career.

He was sent to a seminary in Vendome, whence a learned Jesuit took him to college at Blois to prepare for holy orders. The lad submitted to this cheerfully. It was the natural order — army, navy, Church—that was the round of professions thought worthy of a nobleman in all countries in these times.

The young man was preparing, in the Lent of 1742, with fasting and maceration, to receive the tonsure when Easter Sunday should arrive. One morning his Jesuit instructor took him aside and told him that his eldest brother was dead. The lad of seventeen wept, but the priest bade him dry his tears, saying that he, as his father's heir, should give up all thoughts of the priesthood and go at once to take up his position in the world. There are no signs that Jean Baptiste regretted the change of vocation.

France was at war over the Austrian succession, and as cornet in the cavalry regiment of St. Simon the young vicomte started to flesh his maiden sword. He was as dashing as they made them. St. Simon's regiment had a reputation, and Jean Baptiste lived up to it.

The Duc d'Orleans made him an aide-de-camp, and so he followed the campaigns of Bohemia, Bavaria and the Rhine. When Orleans fell out the Comte de Clermont had the young Rochambeau on his staff, and whenever it was desirable to locate the enemy or catch wind of his manœuvres the youth was pretty sure to be of the vanguard.

His Daring at Namur.

At the siege of Namur, in the Low Countries, he took it into his head to climb a height which had been deemed impregnable, and found only two sentinels on guard who were sitting in the shelter of a gun enjoying a quiet smoke. He did not disturb them, but crept down and sent word to De Clermont. A strong force was hurried to the spot; a cannonade was set up on the other side of the river to divert attention, and before the enemy knew it Namur was theirs no more. For this he was made colonel of a regiment of infantry when he was barely twenty-two. He headed his regiment at the battle of Lawfeldt, and received two severe wounds.

The following year, 1748, he invested Maestricht, on the left bank of the Meuse, with only twenty companies of grenadiers, and then in a brilliant assault captured

the magazine and stores of the enemy. The war, however, had not been brilliant with total results for France, though it had included the superb victory of Fontenoy.

When the peace of Aix la Chapelle came our young colonel gladly enough returned from his six years of battle and camp life, and soon after entered the lists of Hymen, making the beautiful Mlle. Telle d'Acosta, his wife. The next year his son, Donatien, was born at the Chateau de Rochambeau.

What he saw of court life in the next few years did not please him. He was in love with the profession of arms, and hence jumped at the chance of the expedition against the Minorcas Islands, under the Duc de Richelieu. His bravery in the assault upon the fortress of St. Philippe and other forts of Mahon, won him the Cross of St. Louis and the grade of brigadier general of infantry. War was destined to be a pretty constant companion of France, which was also wasting in resources under the prodi-

STATUE OF ROCHAMBEAU, WASHINGTON, D. C.

Unveiled in the presence of the distinguished French Embassy, President Roosevelt, and Government Officials.

galities of the kng and being drained of its best blood in the succession of king-made and mistress-ended wars of the reign.

Captured a Fortress.

In 1757 he was sent to Germany, where, in the teeth of Prince Ferdinand of Brunswick, he captured the fortress of Regenstein. In the battle of Creveldt, the following year, he held the whole Prussian army at bay for hours by a manœuvre that masked his numerical inferiority. As colonel of the regiment of Auvergne he was in the battle of Minden, and his part of it, at least, was glorious. He forced General Luckner to retreat to the gorges of Salmunster, and was wounded in the fight at Klostercamp.

In 1761 he was made marechal de camp and inspector of cavalry. He commanded the right wing of the French army in the battle of Tillinghausen, and when the rest of the line had given way he took his command off the field in such good order, and so cleverly, that the enemy could not break his lines nor cut him off. France was now at the end of its fighting tether for some time. It had lost Canada and much besides, and was fain to be at peace.

In all this one sees in Rochambeau strong soldierly qualities. Brave, acute, pertinacious, a fine tactician and a clever strategist; he was often consulted by the Ministers, such as D'Aiguillon, May and St. Germain. He never relinquished his army commands. He bred his son to the same profession, taking him into the Auvergne regiment when he took command. The son became its colonel in 1779.

It was this fine, grizzling warrior of fifty-five years, thirty-eight of them in service, whom Louis XVI. chose to head the land forces he was sending to America, the king promoting him to the grade of lieutenant general for the purpose. His son accompanied him.

He chafed much at his detention within his lines at Newport, watching the English Admiral Arbuthnot's ships in the offing, where, however, they remained without attacking him or the French fleet. Lafayette had ridden in to see him, but it was not until September that Rochambeau met Washington. It was at Hartford that the meeting took place, and it was graced with much stately politeness on either side, for the natural dignity of Washington was quite on the level with any courtly grace natural to the noble Frenchman.

A New Campaign.

It was there decided that the two armies should later join forces near New York, and Rochambeau returned to his men. Not long after Admiral de Ternay, who had been ailing at Newport, died, and was buried there. On Memorial Day, 1902, the representatives of France laid a wreath upon his grave.

It was on Washington's return from this inspiring meeting that he learned of the discovery of Arnold's treason, arriving at West Point just in time to frustrate it, the wretched traitor fleeing like a dog on learning that the general was coming. Troubles, indeed, seemed to gather around. Money failed. One-third of the American army was in revolt.

Wearily, for the French army, the winter months dragged on in idleness. The

campaign had become a slow moving game of chess, in which fleets and squadrons were the pieces. Rochambeau's son had been sent back to France for reinforcements and aid in money and munitions. And it was long before these came; but France was generous, and Franklin, ever active at Paris, was successful in keeping the French king's sympathy for the struggling nation at the boiling point.

During all their stay in Newport, the French troops were models of discipline and self-restraint. In fact, during the whole two years of their stay in America there was never a moment's trouble between them and the Americans. Rochambeau records the open-mouthed wonder of the Narragansett Indians who, on visiting the camp, saw a tent pitched under an apple tree and the fruit untouched.

Plan That Secured Our Triumph.

Another meeting with Washington had been arranged, and this took place at Wethersfield, Conn., on May 20, 1781. General Knox accompanied the Commander-in-Chief, and the Chevalier Chasteleux was the companion of Rochambeau.

It was there decided that the junction of the French army with Washington's should be carried out as soon as the desired and expected help from France should arrive. Rochambeau's son, indeed, arrived with the needed stores, arms and money on June 8, and on the 18th the French troops crossed over to Providence on a rapid march to the Hudson, taking their light artillery, and leaving their siege guns to follow later by sea. As an example to their men, the officers made the journey on foot. What a change on that line of march since then!

Dark as the hours had been for the American cause, light was breaking all around the sky. Lord Cornwallis had been practically driven north from the Carolinas by the renewed activity of the able General Greene, and was in Virginia, where Lafayette was holding him in check. The French West Indian fleet under de Grasse was reported on its way to the Chesapeake, and this was another factor in the situation.

Wanted to Attack New York.

Washington favored at this time a closer advance to, if not an attack upon, New York. Rochambeau did not favor it. His judgment on the strength of fortified places could be relied on; it was part of the war game he thoroughly understood. Besides, how was the British fleet in New York Harbor to be reckoned with?

The armies were advanced to within twelve miles of Kingsbridge, a line of vedettes thrown out from the Hudson to the East River, and a reconnoissance with 5000 men was made on July 13, 1781, Washington ordering the disposal of the forces. Clinton was greatly alarmed at this. Delancy's Tory freebooters, who plundered travelers—friend as well as foe—in the country between the hostile lines, were driven off, but the strength of the British position at the northern end of the island was fully realized.

It was not hard, then, to take the other great alternative, namely, to attempt the capture of Cornwallis, favored as the scheme would be by the support of the French fleet. But the carrying out of a plan that meant the transfer of a considerable army across a river as broad as the

Hudson in the face of a watchful enemy required boldness and cleverness.

Great efforts were made to deceive Clinton regarding this move, and they were entirely successful. On August 17, 1781, the French troops, with Rochambeau at their head and an American division under the brave General Lincoln, crossed the Hudson at King's Ferry and, keeping behind the hills, traversed New Jersey.

Crossing the Delaware near Trenton, they proceeded to Philadelphia. There were loud murmurs among the American troops and some danger of their refusing to march further, but Rochambeau came to the rescue with $20,000 from the French military chest, and the army passed through the Quaker City, the citizens everywhere acclaiming the French as their deliverers.

The rest of that march is history easily recalled. Cornwallis was at Yorktown; De Grasse, with his fleet, was off the Capes, and sixteen thousand men were soon enfolding Cornwallis and his eight thousand in a net.

As Washington's Guest.

An incident of the journey South was Washington's return to his home at Mount Vernon, after an absence of six years—but only for two days, just long enough to prepare for the coming of Rochambeau, whom he had just left at Alexandria. He wished to give the gallant Frenchman a taste of Virginia hospitality and a single day's rest. On September 10 Rochambeau arrived. On the 12th he started for Fredericksburg. On the 14th they reached Lafayette's camp at Williamsburg. Three days later Washington, Rochambeau and De Grasse held council, and, the French transports arriving with siege guns from Newport, the plans for the capture or annihilation of Cornwallis were perfected.

Splendid French Valor.

The valor of the French in the assaults upon the outer works of Yorktown was fully up to the standard of their renown; but before it could be invoked for a general engagement, Cornwallis saw the point, and on October 17 surrendered.

When he gave up his sword the war was practically ended, and the freedom of the colonies was achieved.

A winter in camp at Williamsburg followed for the French army. For Rochambeau and his officers it was made as pleasant as possible by the landed chivalry of Virginia. Congress honored him with a present of two cannon captured from the English, a laudatory inscription being graven on them. His parting with Washington was affectionate and worthy of the two men who had done so much for liberty.

On Rochambeau's return to France, King Louis gave him the cordon bleu, or knightship in the order of the Saint Esprit—most coveted of knightly honors—and assigned him to the command in Picardy. In 1788 he was sent into Alsace to restore order. In 1790 he commanded the army of the North. Toward the end of 1791 he was made marshal of France.

When consulted in 1792 on the plan in case of war with Germany, he advised a defensive campaign. Dumouriez gave the opposite advice, but at Quiveran the latter's rout would have been complete but for the old marshal coming to his rescue with three regiments of infantry

and eight pieces of cannon. Then his wisdom was recognized.

In the following June, feeling slighted, he resigned and returned to his chateau, near Vendome. There, in 1793, the "Terror" found him and haled him to Paris, where he was imprisoned in the Conciergerie without any particular charge being made against him. His two American cannon were carried off by the revolutionary mob and melted up and coined into copper money. The guillotine was busy, and, after witnessing much of the horror of the time in the prisons, he was ordered to appear before the revolutionary tribunal with every chance of losing his head, something he had never done in battling with the enemies of France.

At Last Released.

Fortunately for him, the ninth Thermidor, with the downfall and death of Robespierre, intervened and he was released. He retired once more to Vendome.

When Bonaparte rose to the head of affairs, old soldiers like Rochambeau were safe. Presented to the First Consul, in 1803, Bonaparte said to him in the presence of a group of generals: "Marshal, behold your pupils!" to which Rochambeau replied, in courtliness and truth: "The pupils have surpassed their master." He was made a grand officer of the Legion of Honor by Bonaparte, and granted the pension of a former marshal. He wrote his memoirs and died serenely at his chateau in 1807, at the age of eighty-two.

His son fought under Napoleon with distinction. Sent to the West Indies, he was in command at San Domingo, and sustained a prolonged siege, surrendering at last to the English, who agreed to allow him to return to France. In direct violation of this treaty, however, they captured him on board the ship that was taking him home. He was held prisoner in England for eight years; in fact, until he was exchanged in 1811. In France he at once re-entered the army, and in 1813 fell at the battle of Leipsic. It must be remembered that he, too, fought for American freedom.

For Liberty and Independence.

It may well be recalled in this day and hour that when France made alliance with us, it was for "the liberty, sovereignty and independence, absolute and unlimited, of the United States," and that France kept her word, never asking or receiving, for all her outlay in blood and treasure, any other return than the gratitude of a free people.

This gratitude she has received, and the descendants of Rochambeau were accorded a hearty welcome on the occasion of the unveiling of the Rochambeau statue in Washington.

That the United States are under profound obligation to France for her sympathy and aid in our great struggle for liberty, is a fact fully recognized by all Americans. When dark hours hung over the little band of patriots led by Washington, it was the timely help of Lafayette, Rochambeau and other French heroes, including the rank and file of the French army, that raised the hopes of the "embattled farmers," and spurred them on to victory. Never will the blood shed by foreign heroes in our greatcause cease to be regarded as a sacred sacrifice.

GREATEST NATURAL WONDER

The Falls of Niagara—Grandeur and Magnificence of the Far-Famed Cataract.

THE great natural wonder, the Falls of Niagara, were discovered by Pere Hennepin in the year 1678. The Niagara river, forming the boundary line between Canada and the States, flows almost north for a distance of thirty-six miles of which twenty-two are above and fourteen are below the Falls. Above the Falls the river encircles a large island, known as Grand Island, its course thus far being quiet. Presently, however, it begins to feel the influence of the coming leap, and sweeps along more impetuously, and soon breaks into furious rapids.

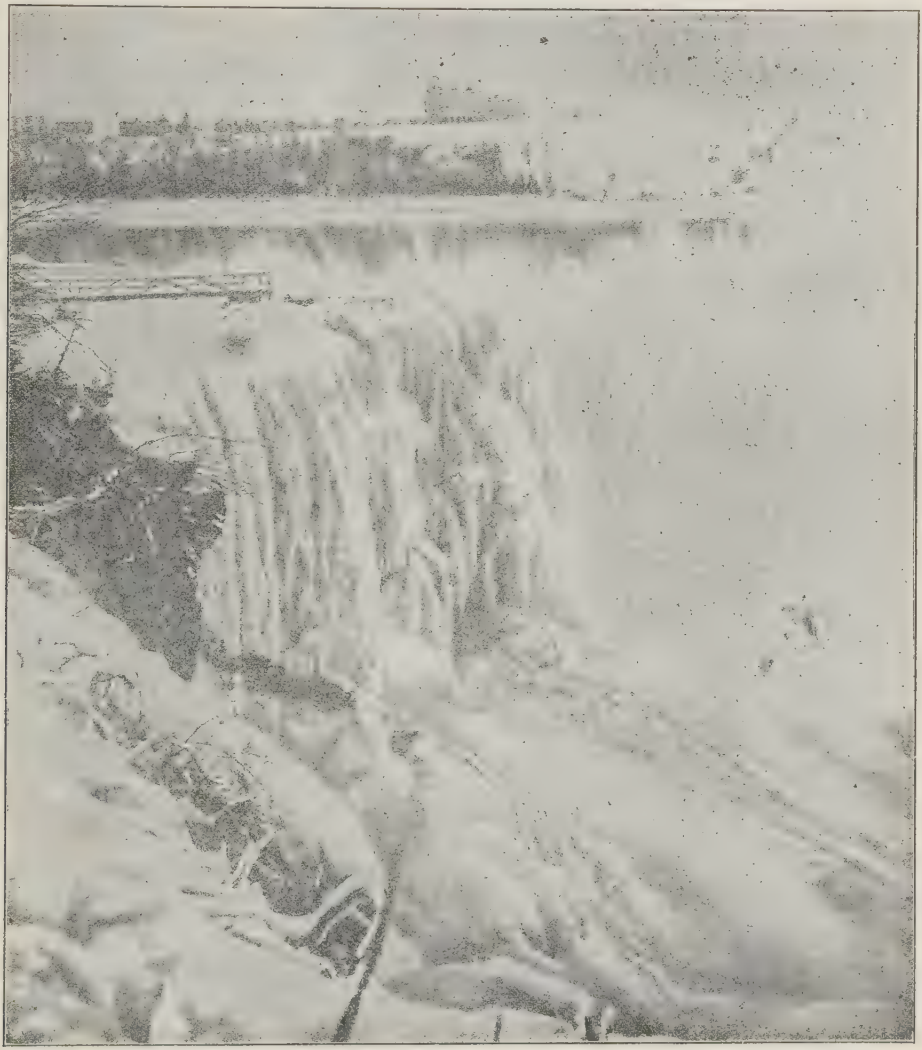
Reaching the head of Goat Island, it separates into two branches; that on the American side rushing straight forward to the brink in a mass a thousand feet broad, and shooting over into the gulf below. That on the Canadian side of Goat Island sweeps around and plunges over a cliff in the form of a horseshoe (hence the name of this Fall), the two parts of the river mingling at the foot of the Fall. The height of the American Fall is one hundred and eighty feet. That of the Horseshoe Fall is slightly less, owing to the smaller height of the crest. Its leap is one hundred and seventy-three feet.

As the current approaches Goat Island it seems to flow with redoubled velocity. It is impossible to conceive anything equal to the force and swiftness of its progress to the ledge of rocks over which it is propelled, till it impetuously tumbles into the bed of the river beneath, with a noise louder than thunder. When the waters fall into the deep basin, they rebound into the air in immense spherical figures, white as snow and sparkling as diamonds.

These figures, after rising and apparently remaining stationary for a moment, explode at the top and emit columns of spray to an astonishing height. They then subside and are succeeded by others which disappear in the same manner. From that part of the Table Rock which yet remains, the spectator commands one of the grandest and most romantic views in nature. The tremendous rapids above the Falls—Goat Island in their midst, covered with trees, which seem at every moment about to be swept away; the Horseshoe Fall, immediately below Table Rock; Fort Schlosser, beyond Goat Island; and the frightful gulf beneath, boiling with perpetual rage and shooting upwards immense volumes of sparkling foam, smoking with apparent intensity of heat—are a few of the great objects which are forced upon his attention.

Another place from which the Falls assume, if possible, a more striking and awful appearance, is at the bottom of the cataract. The precipice leading to this spot is descended by means of a ladder,

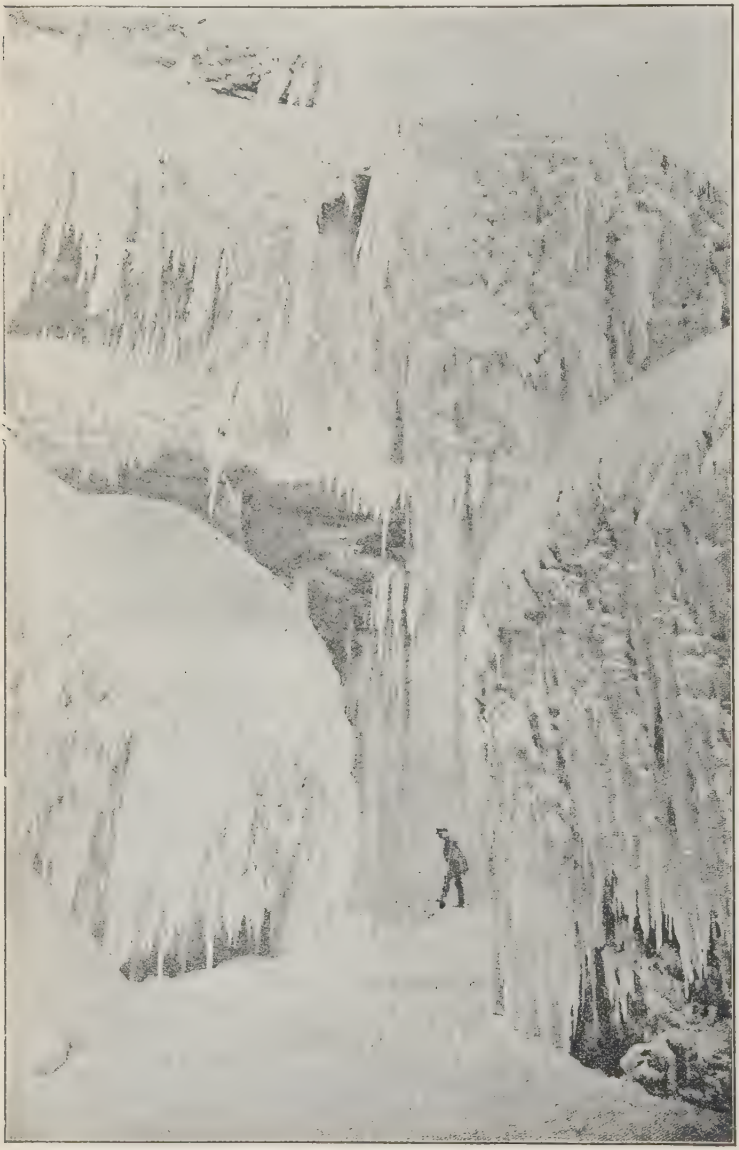
the perpendicular height of which is upwards of sixty feet; you proceed along the edge of the river, which is covered with broken rocks, wrecks of boats, and other rubbish, until you arrive at the bottom of the Horseshoe Fall.



TERRAPIN ROCK AND HORSESHOE FALL IN WINTER.

From this place visitors frequently proceed on foot several hundred yards, within a prodigious sheet of caverned water, which is formed by the overshooting of the cataract. But they must be men of the firmest nerve who venture on such an enterprise, for the most undaunted resolution was in danger of being shaken on looking upward at the impending rock, which continually seems to bend and groan beneath the rolling flood to which it serves as a fearful support. From the projecting edge of this rock the mass of waters is impelled forward, and leaves a

large and smooth expanse, which reaches from the sheet of falling water to the very base of the gradually undermined mountain.



ICE FORMATION AT NIAGARA FALLS.

Every day sees something taken from the rocky barrier; and, geologically speaking, at no remote time our Great Lakes will have shared the fate of those that once existed at the far West. Already they have been reduced to less than half their former area, and the water level has been depressed three hundred feet or more. This process is pretty sure to go on until they are completely emptied.

The cities that now stand upon their banks will, ere that time, have grown colossal in size, then gray with age, but in the sediments that are now accumulating in these lake basins will lie many a wreck and skeleton, tree trunk, and floated leaf. Near the city sites and old river mouths these sediments will be full of relics that will illustrate and explain the mingled comedy and tragedy of human life. These relics the geologist of the future will doubtless gather and study and moralize over, as we do the rocky records of the ages past.

The Yankee spirit of utility has made the cataract of Niagara furnish motive power for a variety of purposes. The great marvel is made to work as the lumberman makes the creek turn his sawmill. Buffalo and other places get motive power from Niagara. A large amount of capital is invested in this unique enterprise.

A WOMAN'S PLUNGE OVER NIAGARA FALLS

**Strapped in a Barrel She Goes Over the Cataract—
In the Torrent Below—A Foolhardy,
Yet Daring Feat.**

WHEN a paragraph appeared in the newspapers to the effect that a woman had successfully accomplished the unique feat of passing over the Niagara Falls in a barrel, there were many persons who thought the statement incredible. It is now possible to give a detailed account of this astounding journey undertaken by Mrs. Anne Edson Taylor, on her forty-third birthday. The attempt, though successful, seems foolish and rash, but the facts of Mrs. Taylor's case explain what would otherwise seem to have been an irrational attempt.

She was born at Auburn, New York; and at seventeen married a medical student in Yates county; but before she was twenty, was left a widow with a single child, who died a year later. Since then, she has supported herself. She became a college graduate, has taught dancing, and has acted as companion to several women of high social position.

With advancing years, however, she found it increasingly difficult to make money, and finally a disastrous fire broke out on her small farm. If she could not get enough money to pay off the mortgage on this farm nothing but scrubbing, she said, lay before her. As she is a refined, well-educated woman, she refused to sink to this, and conceived the idea of going over Niagara Falls and thus gaining a notoriety which she would be able to coin into money.

Construction of the now Famous Barrel.

Mrs. Taylor herself designed the barrel, working out the details with such aid as she could get. During the trip she wore the belt that Captain Johnson, the life-saver, had advised her to use after she had sought his advice—he had tried in vain to dissuade her from making the trip. Two large cushions protected the front and back of her body from the shoulders to the knees.

In front of her face were three small airholes. Into one of them was fitted a piece of rubber hose four feet long, with a spout which she could hold to her mouth for air if the supply to be pumped into the barrel gave out before she was picked up.

On the day appointed for the plunge Mrs. Taylor started for the Falls, having been rowed out to Grass Island by boatmen. All things being in condition satisfactory to Mrs. Taylor she cheerfully gave the order to close the manhole and pump the air in.

The barrel and Mrs. Taylor were sent adrift. It was planned to have the barrel caught by a current that would carry it

toward the middle of the Horseshoe Fall, 158 feet high. At any other place destruction would have been absolutely certain, for the water falls on the rocks with a force that would crush any craft made by human hands. But on the brink of the Horseshoe Fall there is a great expanse of deep, smooth, green water that drops into a hole of unknown depth below. Both above and below there are fewer rocks than at any other part of the Falls.

MRS. TAYLOR IN THE BARREL.

This diagram shows how Mrs. Taylor was strapped down to the bottom of the barrel so that her head could not strike against the top. The weights at the bottom kept the barrel erect.

By astonishing luck the barrel did exactly what it was expected to do. Even on the way to the brink death was threatened by jagged rocks on every side, but the conservative barrel kept to the middle of the current. At 4.23 P.M. exactly, it shot over the edge of the mighty Horseshoe Fall at a nice smooth place. Just after the barrel passed the brink the head tilted forward, but it righted itself immediately. It went down in an upright position—that is, bottom first down the cataract.

The Drop Over the Falls.

"It was just as if I could feel myself hanging on the edge of a sheer precipice and shutting my eyes before the drop into the abyss. Now I tell you I knew exactly where I was. I knew I was on the edge of the precipice and braced myself for the shock, and I think that for about three seconds I lost my reason. I did not faint, but my mind was gone. I was oblivious of everything. The next thing I knew I was in the cataract below. It must have been the velocity of going over that took my senses away."

In the Cataract Below.

The barrel shot down the face of the cataract with lightning-like rapidity. Then it disappeared in a boiling cloud of foam. Half a minute later it bobbed up in the turbulent river. At 4.40 several men caught the barrel with poles from a rock on the bank of the river. The spot was 600 yards from the falls. They were surprised to see it uninjured. They pulled out an airhole and called out: "Are you

alive?" Mrs. Taylor replied in a faint voice: "Yes."

They had to saw off the top of the barrel to get it off. Then they picked Mrs. Taylor out. Her face was bruised, but she was able to walk to a carriage with a little assistance. An evening's nursing restored her.

The barrel was picked up and brought ashore at a point nearly opposite the little landing stage of the "Maid of the Mist" steamer. The Horseshoe Fall, over which Mrs. Taylor went is 173 feet high. She successfully performed her dangerous journey in seventeen minutes, and came out without serious injury.

LARGEST SCHOOL IN THE WORLD

Nearly 400,000 Pupils Never See Their Teachers—The Phonograf and Special Trains Used With the Mails to Give Instruction on any Subject Desired—How to Get an Education Without Giving Up Work.

THE largest school in the world is in Scranton, Pennsylvania. This is one of the facts in our present life that may surprise every one, even Pennsylvanians. It has 372,000 pupils, yet practically none of them has ever seen their teachers or ever expect to. For most of the instruction is done by mail. What cannot be taught in that way is taught in other ways equally unique. There are four trains of special cars attached to this school, and in them the teachers make the swing around the circle. They visit pupils who need special instruction and give them what they need. And besides this the phonograph is put into practical use and made to perform the office of a teacher. This school is designed to help the most needy persons in the world, that enormous class of industrial workers who can't afford the time from their grinding work to learn something better in their own line.

Mark that well! The fireman, who wants to be an engineer has no time to study mechanical engineering. He cannot resign his place and go to school, so he takes the lessons in the cab windows between shovels of coal. The worker down below the bottom rung of the ladder of a gret factory or institution wants to learn how to go up on the ladder. His chances for promotion are indefinitely greater when he knows enough to take the step above him and grasp its opportunities.

To these men, and over a quarter of a million like them, in all kinds of industries, does the International School of Correspondence appeal. It has had the test of time now, and has been found a

success. It has enrolled more scholars than the combined register of the universities of the United States.

In October, of one year, twelve thousand pupils entered their names on the books. It has taken ten years to get this school method in the minds of the workers down in the scale of life. The first year or two only a thousand scholars were persuaded to join. To-day, one miner tells it to another in the day's work below the earth's surface; one brakeman tells it to a group of lounging railroad men on the sunny side of the round house; one woman stitching in the top of a factory shows her certificates for which she has labored and studied during the leisure hours; a clerk in a great importing house gives his employer a showing of his ability to grasp the French and German correspondence, and he is promoted.

Great Educational Work.

And so it is that all through the lower threads in the complicated weaving of our web of industry is this educational work going on.

That is why the work is practical. Each pupil who enters the school gives his reason for entering and what his ambition is. With that aim alone is the teaching given.

The man is taught to be what he wants to be. He is not bothered with a heap of glittering information that he doesn't want; that wearies him; that he doesn't understand. He is one of the great unreached multitude that education has not gotten down to, because he has been trained to work and not to learn.

If a miner wishes to learn to be a foreman, his entire course of teaching is to fit him for that position. If a country doctor in some far away village wishes to learn the use of electricity, he takes the course in electro-therapeutics. If a woman is cooking for her living and wants to become experienced, she takes a course in chemistry.

Choose Their Studies.

The girl with a talent for drawing, who sees an opening for an architect in some little town where she lives, she takes a course in architecture. The man shoeing the horse who wants to rise, takes his course to be a scientific blacksmith. The man in blue overalls oiling the engines in the basement of some great plant studies his papers when he is not needed and puts himself ready to go higher when the opportunity comes.

This school is not designed to give help to the idle. It does not refuse that, but its work is among those who must study as they work.

To most men and women there come leisure moments in the long day's work; it is only those at the top who have no leisure; their brain and their responsibility provide work for eighteen hours out of twenty-four. It is only at the top that no one observes the eight-hour system.

If the day laborer had to work as long and as hard as the master mind that guided the corporation, he would be in a constant state of striking. It is the man who takes orders that has time between orders; and it is he who takes advantage of this school.

The system is very thorough. Nothing is demanded but concentration upon the one thing the man is studying. No time

limit is given. A scholar takes as long at a course as his mind requires. His certificate is not given him until his examination papers are over 90.

List of Questions.

First, an instruction pamphlet is sent out, then a pamphlet containing test questions by which a pupil can see whether he understands what he has studied. After this he receives a list of examination questions, so arranged that if he should wish to be dishonest about it he couldn't be.

He sends his answers to the teachers for correction. If his percentage is not over ninety his papers are returned with the corrections.

He has a second, a third and a fourth chance. If he is especially back and doesn't grasp the examination easily, a special expert in that course of study is detailed for him and they work together day by day until he passes the mark.

The railroading class is the largest of all, and there is so much mechanical work to be done in this and the pupils are so scattered over the United States that cars have been fitted up for special work in lecturing and demonstrating. And these, under the guide of experts, tour the States. There are four of these always traveling on the principal lines of the country, stopping at all the stations necessary. The pupils of these classes are notified of the date of each instruction car, and they gather to these practical lectures.

Here they can ask questions and get practical demonstration of all the mechanical things that puzzle them.

Another very interesting development of the system is the the teaching of foreign languages by phonograph. This has been taken up by some of the best business men in large cities, even, who have no time to leave their offices to study. They turn on the phonograph at their side when they are not busy, or during the lunch hour, and faithfully study the language through this medium.

A German teacher or a French teacher gives the lesson to the phonograph so that the pronunciation is perfect. In that way the scholar gets far better instruction than from schools where a French-speaking American tries to speak the words. The school furnishes phonograph with the course, with special device that makes it repeat itself.

A Marvelous System.

When you grasp it, this is really a marvelous piece of work going on among us. Doubtful if it could thrive or succeed in any other country but ours. The tremendous examples in the industrial life of our country show that a blacksmith may become a millionaire magnate if he only knows enough.

It is among the lowest order of industrial life that the ranks are over-crowded. As soon as the laborer can be made to understand that every step up he takes the more elbow room does he get and the easier it becomes to take the next step, he is already on the way to success.

It is this colossal lesson of industrial development that is being taught to nearly 400,000 pupils this year. If these 400,000 double the number by their success, it will only mean that a great moral system will be preached as well as an education given.

Thousands and thousands a year could be promoted by such a system off the lowest rung of the industrial ladder, and there would be millions to take their places

Great schools are great institutions, but we all know dozens of pathetic cases where the man who wanted to learn had no chance to learn. The pot must boil is the fatality in most men's lives. This is the one remarkable system that gives man a chance to put fuel under the pot while he is learning to control forests of timber.

A CELEBRATED PAINTER

He Has No Arms, but Uses His Mouth as a Substitute for the Hand.

IN the history of the contemporaneous art there are but four names of painters recorded to whom nature has denied the gift of hands and arms. These four persons have all won distinction, and the names of Francois de Mentholon, Aimee Rapin, Noel Masson and Amelia Biffin have risen triumphant from that circle of "freak" examples of humanity who have exhibited their deformities rather than their artistic skill.

Not far from this quartette of celebrities, whose names will always be remembered in the history of art, must be placed that of Bartram Hiles, a man who, up to the age of eight years, was as free from either misfortune of birth or accident as any other hearty, healthy boy who plays cricket, fights fistic battles and flings vagrant stones into limpid pools.

Born in Bristol, in Gloucestershire, England, young Hiles, from the time he began to walk and talk, showed an immense anxiety to become an artist, and for so young a child his drawings were instinct with talent. When he was eight years old young Hiles' arms were cut off by a street car. He then learned to draw by holding a brush between his teeth.

He looks more like an American college-bred man who has played base-ball and foot-ball than an artist who has had to struggle against such misfortune as few men have had to encounter. His manner is alert, cheerful and businss-like.

It is amazing to learn that two years after the time that he lost his arms as a boy ten years old, Mr. Hiles had by dint of steady and ceaseless work succeeded in obtaining a "First Class Excellent" prize in the second grade of a Bristol school for (the pathos of it!) "free-hand" drawing! After this, when he had scarcely entered the early months of his "teens," he was sent to an Art Class at a Technical College in Bristol, where he made rapid progress and successfuliy passed numerous art examinations, in which the subjects, incredible as it may seem, included modeling!

When he was sixteen Mr. Hiles exhibited his first study in water colors at the

Academy of Fine Arts in Bristol, where it found a purchaser, not because it was known to be the work of a helpless cripple, but because it was considered to be of real artistic merit.

Mr. Hiles says that it took him practically from five to six years to obtain complete mastery over his mouth and the muscles of his neck. Now he can hold a brush or pencil between his teeth and guide it with such supreme delicacy of touch by movements of his tongue and head that his mastery of line-drawing as well as his broad and firm freedom of brush touch is, even among well-known artists, regarded as amazing.

Among other honors Mr. Hiles has succeeded in winning the art scholarship at the National Art Training School, valued at about $600. He has also been awarded one silver and two bronze medals in the national competition for painting. He studied in the studios of Paris, and is a constant student of such storehouses of art treasures as the National Gallery and the South Kensington Museum.

In all these successes of artistic competition it must be taken into account that absolutely no favoritism was shown to him because he was unable to employ the same members as other students in the accomplishment of his work. "Always remember," he said, as he exhibited an exquisite little bit of water-color work called "Homewards," "that my method of work is frequently entirely unknown to the judges who have commended it. It is my ability that is considered, and not my misfortune."

This indomitable spirit of pride that enables him to conceal his infirmity when he can is evidently the keynote to the young artist's character. His great ambition is to be able to give his entire attention to water-color work, but in order to turn that "honest penny" that is a necessity in the lives of laborers in the vineyard of industry Mr. Hiles gives most of his attention to designing beautiful conventional patterns for dadoes and friezes. His book plates, "headings" and "tail pieces," as decorative black and white work, are quite admirable in their beauty of design and freedom of execution.

AN ARTIST WHO PAINTS WITH HIS MOUTH.

The following is an additional account of this phenomenon among famous artists: Mr. Bertram Hiles lost both his arms through a tram-car accident when he was eight years old, but that did not check the strong instinct for drawing for which he had already developed. So he set to work with indomitable courage and learned to draw with his mouth—to such good purpose that he obtained a "first-class excellent" in the second grade for free-hand drawing at the school he was attending in Bristol. Later on he became an expert at modeling. At the age of sixteen he exhibited a water-color study at the Bristol Fine Art Academy, and he ultimately won the National Art Scholarship at the National Art Training School, tenable for two years, and valued at $550.

He afterwards studied in Paris. He has exhibited in the Royal Society of British Artists, the Dudley Gallery, and is a worker for several firms of decorators. His pictures were bought by Queen Victoria, while Queen Alexandra and Mr. Walter Crane possess specimens of his work. The extraordinary part of his achievement is, of course, that he started life with arms, for most armless artists have come into the world without them and never knew what their existence meant. Possibly he paints better with his mouth than he would with a right hand

FAMOUS DISH FOR EPICURES

How Turtles are Caught and Made Ready for the Market.

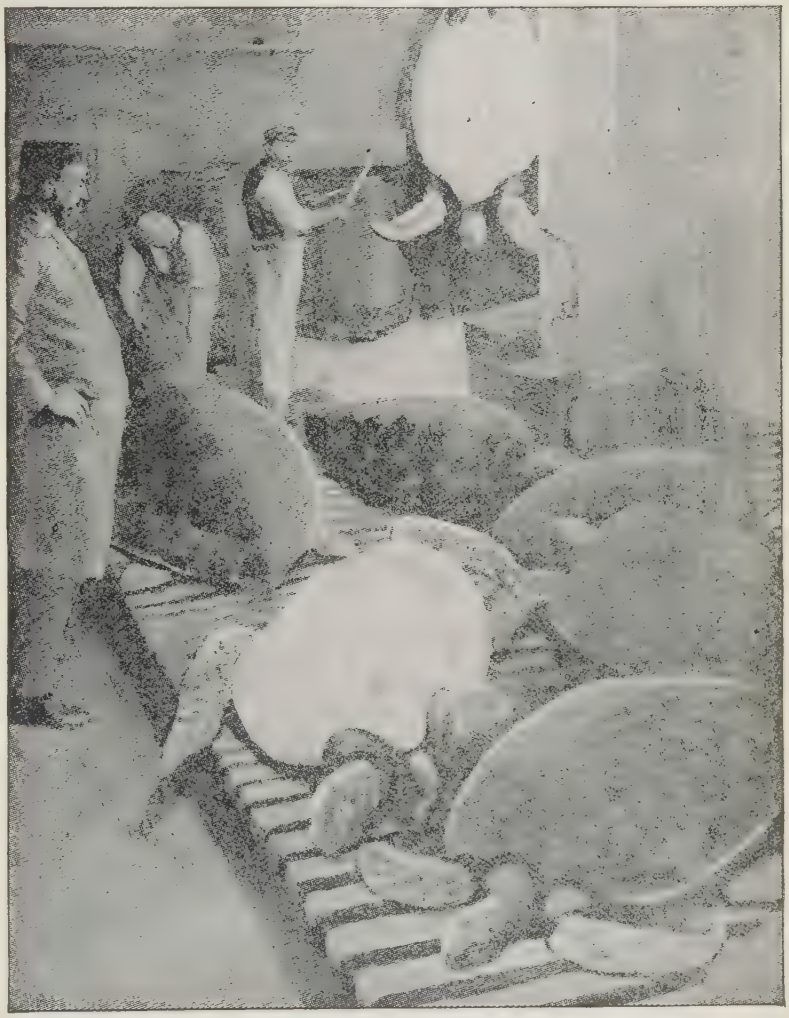
THERE are edible turtles, of which there may be more than one species, but the type is the green turtle of commerce and city feasts. They are free swimmers in the great oceans within the tropics, and sometimes they wander beyond this limit. Liking deep water—for much of their prey is found in the warm surface water, not near shallows—they beach themselves on almost all the islands where there is a sandy shore in which they can dig a hole and deposit their eggs.

They are seen very generally about the warmer parts of the ocean within a few miles of land, and also hundreds of miles and farther from it, swimming or floating on the surface, and diving for a long time before reappearing. Although cumbersome on land, the largest of them, which may be seven feet in length, and weighing 800 or 900 pounds, swim easily and rapidly, and the smaller individuals, which may be watched in an aquarium, are most elegant in their natation, feathering their flat and curved arms with great skill when desiring to change the level of their swim.

They live on the gelatinous swimming things of the ocean, the cuttle-fish tribes, the molusca without much shell, and probably on fish. When near land they

devour marine plants, and some are stated to wander on shore after green food. At certain times of the year shoals of them arrive at the laying stations, and usually choosing the night, crawl upon the beach, burrowing, as it were, in the sand with their flippers. The females lay a number of spherical eges, like tennis balls in shape, which are slightly flexible and membranous externally.

Mr. Moseley, in noticing the turtles of Ascension Island, writes: "At Ascension Island turtles are collected, and by the side of the 'pond' in which they are kept there is an enclosed space of sand. The turtles dig deep holes in it large enough to bury themselves, and lay their eggs at the bottom. The eggs are always covered up by the turtle, and evidently require moisture as well as an equable temperature, of no great amount, however, for the sand in which hatching takes place does not feel warm to the hand. Evidently the former opinion that these eggs were incubated by the direct heat of the sun is erroneous."



PREPARING EDIBLE TURTLES FOR THE TABLE.

The fresh egg is not quite full, so that there is a depression or crumple upon it, but shortly before hatching it beomes tense. When hatched, the young turtles are lively enough, and are great gormandizers; they use their fore limbs not only in swimming, but also in tearing their food, so as to assist the mouth.

The young are hatched in from eighteen to thirty days, and make their way at once

to the sea, being, however, in great danger from many enemies until they reach it, and even then they are preyed upon by turtle-loving marine creatures. The number which do escape and live must be very great, for the extent of the shores of the Atlantic and of the islands of that ocean visited by laying turtles is enormous.

Dig Holes in the Sand.

Audubon described the life of the turtles during their egg-laying at the Tortugas, a group of islands about eighty miles from the coast of Florida. After noticing their circumspect approach during the moonlight nights to the shore, and their crawling motion up the beach, he says that the turtles raise the head to the full stretch of the neck, and, after gazing around, form a hole in the sand with the hind flippers, using them as ladles, and casting the earth forth for several feet.

This may not go on, perhaps, for more than nine minutes, and then the eggs are dropped in regular layers, to the number of from 150 to 200. This takes about twenty minutes, and then the sand is scraped over the eggs again, and the turtles rush back to the water with all speed. It appears that these wanderers in the ocean return to the same laying-ground during the breeding season.

They are caught on shore by being upset and turned on their backs; and this is usually done with stout poles, as well as with the help of the shoulder, and several men may have to join in doing this to a large individual. They rarely are able to turn back again, and are secured by the legs in the meanwhile. Sometimes nets are used to catch the smaller ones, and harpooning is also resorted to. But the prime object is to capture the turtle alive for the markets of the great towns of the world.

These edible turtles have the carapace depressed, broad, and ornamented, with fifteen disc-shaped, horny scales, making up the outside shell. Their head is broad, but the muzzle is short and rounded, and the upper jaw has a slight notch in front and small, jagged points on the sides. The horny case of the lower jaw (or beak) is formed of three pieces, and the sides, are deeply indented. The tympanum is hidden by skin, and there is a nail on the first toe of each foot.

Curious Creatures of the Sea.

Turtles are among the curiosities of the ocean. When caught and placed in the windows of restaurants, they attract the gaze of the passing crowd. Covered with a hard bony shell, they can resist a heavy blow, and, although sluggish in their movements, can easily defend themselves against many of their foes. But man has various devices for catching them, and in seaboard towns they afford material for a large and lucrative trade.

There is even such a thing as mock turtle soup, and in most cases very rightly named, too, for it is a mockery compared with the real article of diet. To look at these inhabitants of the sea, one is apt to wonder if such an unattractive object can serve any useful purpose. It is another of the many instances in which the most unpromising things to look at can be turned to practical account.

How it was ever discovered that such a thing as a turtle could be turned into an

article of food is somewhat of a puzzle. The epicure, however, would about as soon part with any other article of diet on his table as that of the edible turtle. Happily one does not need to think of the ungainly looks of this creature while feasting upon the delicious soup that is made from it.

JAPAN: A WONDER AMONG NATIONS

By Marvelous Strides She Has Become a World Power in Twenty-five Years.

THE eyes of the world are upon Japan. She occupies a more important position in the defensive alliance just formed than does England herself. In many respects the Japanese are the most wonderful people in the world. Their march as a nation to the position of a world Power, all of which has been accomplished in the past twenty-five years, is little short of marvelous.

The Mikado of Japan, Mutsu Hito, has the bluest blood in his veins of any ruler on earth. He is the 121st ruler of the Island Empire, and can trace his ancestry back to Jinmu Tenno, the first Mikado who occupied the imperial throne, 660 years before the star blazed above Bethlehem.

He was born at Kyota, November 3, 1852; was declared heir apparent at the age of 8, and succeeded to the purple on the death of his father in 1867, although he was not crowned until the following year. In the same year, 1868, he married the Princess Haruko. This same year, 1868, was memorable because it witnessed the overthrow of the feudal system and established the Mikado as sovereign. For twenty years after the overthrow of the old nobles, or Shoguns, the Mikado was absolute monarch. It was Japan's infancy in the ways of the world.

The New Era.

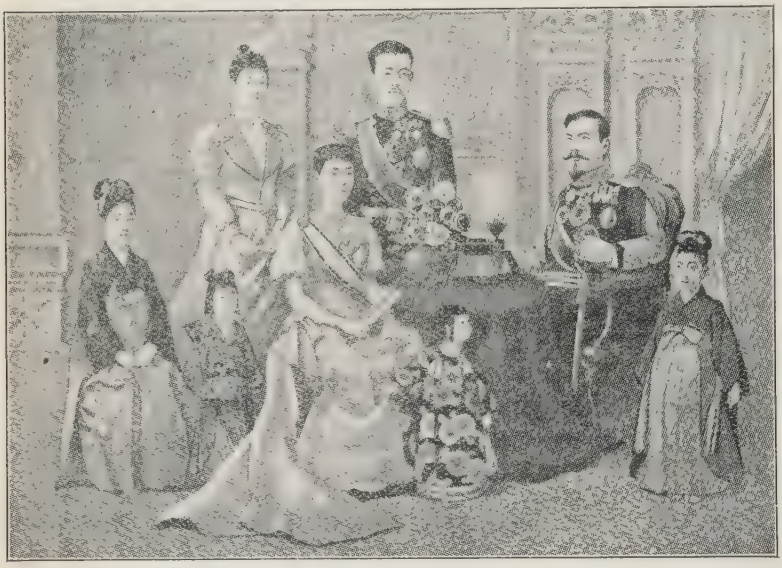
But during this time the leaven of Occidental civilization was working in the realm. European models of monarchial government were being carefully studied; laws suitable to the people of the Empire with their limitations were prepared, revised and re-revised until in 1889 a new constitution was granted the people and promulgated February 11 of that year.

On that day the Mikado, in the presence of the representatives of the nobility and commons, took the oath of "maintenance," and handed to the Minister of State the five laws forming Japan's new system. These laws are:

The Constitution of the Empire of Japan; the imperial ordinance concerning the House of Peers; the law of the House of Representatives; the law of election of the members of the House, and the law of Finance. Under this constitution the parliamentary system of Japan is vested

in a House of Peers and the House of Representatives, both constituting the Imperial Diet.

The House of Peers is partly elective, partly hereditary, and partly nominative. The lower house, which consists of 300 members, is elected by ballot by the people. The first popular election in Japan



EMPEROR OF JAPAN AND HIS FAMILY.

was held in July, 1890, and was marked by incidents and episodes so characteristic of popular elections in European countries as to command attention. There were riots, free fights, and general turmoil, but the event was an object lesson to a people who enjoyed the suffrage franchise for the first time.

Other concomitants of Occidental civilization followed rapidly in the first successful step to popular government. High officials were charged with misdemeanors and defalcations; there were hitches in the operation of the internal law, but the upward march of Japan never halted.

The next, and possibly greatest step that the Empire took, was on July 17, 1899. On that day, acting under treaties with European nations and the United States, for the first time in history, there was confided to the jurisdiction of a yellow Asiatic race, non-Christian, and but recently arisen from mediæval superstitions, the affairs of life and property of white-skinned Christian races.

On that day the extra territorial privilege which had been enjoyed by whites, viz., that of being judged under the jurisdiction of consuls or magistrates appointed by their own governments, was abolished in Japan and all foreigners became subject to Japanese law and Japanese judges. While the experiment was viewed with apprehension, there has been nothing in its operation thus far to justify regret.

The War with China.

The war with China had a great deal to do with opening the eyes of the world to the power of Japan and her dominant position in the far East. The terms of her treaty of peace signed at Shimonoseki, were broad and comprehensive, and benefited the white races quite as much as it did Japan herself. She forced China to repeal the odious Likin tax; forced a uniform standard currency; opened

Chinese factories to foreigners and foreign machinery, and accomplished other reform without the interference or suggestion of Western nations.

On October 1, 1898, Japan put in operation a new coinage system. It was the establishment of the gold standard. During the preceding thirty years, she had experimented with and put to the test all the theories about money advocated by political economists. She had tried the silver, the gold, the double and incovertible paper currency standards.

The Gold Standard.

Under her new coinage law of 1898 the unit of value became the gold yen containing 11.574 grains troy. It is worth about half as much as the old gold yen whose value was 99.7 cents American money. The subsidiary coinage consists of silver, nickel and copper. Gold is an unlimited legal tender, silver to the amount of ten yen or $5, and copper to the amount of one yen.

On January 1, 1899, Japan proclaimed a new statutory tariff. It marked the inauguration of new treaties with Western Powers. The tariff that had been in effect to that time bore the date of 1866. Conventional tariffs were at the same time proclaimed with England, Germany, France and Austria, but under the favored nation's clause, the United States enjoys all the benefits of these tariffs.

Indeed, ever since Commodore Perry forced Japan to open her treaty ports to Western civilization, the United States has been in more sense than one "a favored nation" with Japan. She has sent more of her children to be educated in the United States than to any other country. There are more Americans in Japan to day than of any other Western nation.

Making a Navy.

In preparation for her advent in the world's amphitheater as a first-class Power, Japan mapped out a naval construction programme five years ago that has been lived up to very closely ever since. The plan covers a period of nine years and involves, at the close of 1902, the following formidable fleet:—

Six first-class battleships, from 12,510 to 15,240 tons; one ironclad of second-class and 7335 tons; six protected cruisers, of 9200 tons each; seven second-class cruisers of more than 4000 tons; six third-class cruiser of 3000 tons; twelve cruisers of the fourth class and over 1500 tons; three torpedo gunboats of 1200 tons; twelve topedo catchers; 115 torpedo boats, and twenty-five gunboats.

Japan is Russia's most uncompromising opponent and persistent foe. The world knows that her alliance with England is an anti-Russian movement. The watchful eyes of the Mikado and his people have ever been turned to the north, to where the Russian invasion of China by way of Manchuria was anticipated. Indeed, it was not even a diplomatic secret that the planning of the above powerful fleet was laid out in connection with the opening of the Trans-Siberian railroad to the Pacific, and in view of the Russian naval increase then progressing.

What makes Japan a formidable sea power of the future, as indeed she is of the present, is the fact that all of her fleets are kept in the condition of highest efficiency. The battle of the Yalu demon-

strated the effectiveness of Japanese gunnery and the discipline of Japanese seamen. Few more wonderful advancements in naval power have been witnessed than are presented by Japan.

The naval and military officers of Japan are subject to rigid discipline and careful education. In fact, they are highly educated and drilled men. An extensive plan of army reorganization followed the war with China.

Figures of Interest.

The following facts and figures are of interest concerning Japan at the present time:—

The revenue during the latest available year is estimated at $227,267,564 and the expenditures $227,633,420. The public debt is $450,867,249. The total strength of the imperial army is 157,829 officers and men and the reserve 603,116. Her navy counts of a total of 309,358 horse-power, 187,103 tons of displacement and 895 guns.

The imports from the United States to Japan in 1899 were the third largest of any nation, Great Britain ranking first and British India second. Japan exported 33⅓ per cent. more stuff to this country in 1899 than to any other country, the amount in round numbers being $58,000,000.

The Emperor Mutsu Hito, 121st emperor of Japan, was born at Kyoto, November 2, 1852, and is the second son of the late Emperor Komei and of the Empress Fujiwara Asako. His Majesty was declared, November 10, 1860, heir-apparent to the throne, to which he succeeded on the death of his father, February 13, 1867. At the time of accession His Majesty was sixteen years old. The restoration was effected in the same year by the resignation of his office by the Shogun.

On April 6, 1868, he took an oath which promised that a deliberative assembly should be formed and all measures be decided by public opinion. The coronation of his Majesty took place at Kyoto, October 12, 1868, and the term Meiji was adopted as the designation of the era of his reign the 23rd of the same month. In the third month of the second year of Meiji (1869) the capital was removed from Kyoto to Tokio. In the fourth year of Meiji, on the fourteenth of the seventh month, the feudal system was entirely suppressed.

Emperor's Family.

On the first day of the twelfth month of the fifth year (1872) a conscription law was promulgated and the military system was reformed. The Constitution was promulgated by the Emperor February 11, 1889, and the Imperial Diet opened formally on November 29, 1890. The Emperor was married to the Empress Haruko, February 9, 1868.

The Empress Haruko, the third daughter of Ichijo Tadaka, a noble of the first rank, was born May 28, 1850, and declared Empress of Japan on the day of her marriage to the Emperor, February 9, 1869. They have a large family of children.

The "Yankees of the East," as the Japanese have been called, are a progressive, intelligent people, quick to adopt new ideas and very patriotic in the defense of their own country and its interests. Their navy is a marvel of completeness, and their enterprise is remarkable.

LIQUID AIR

One of Nature's Greatest Forces—Latest Motive Power Discovered—Its Application to the Running of All Kinds of Machinery.

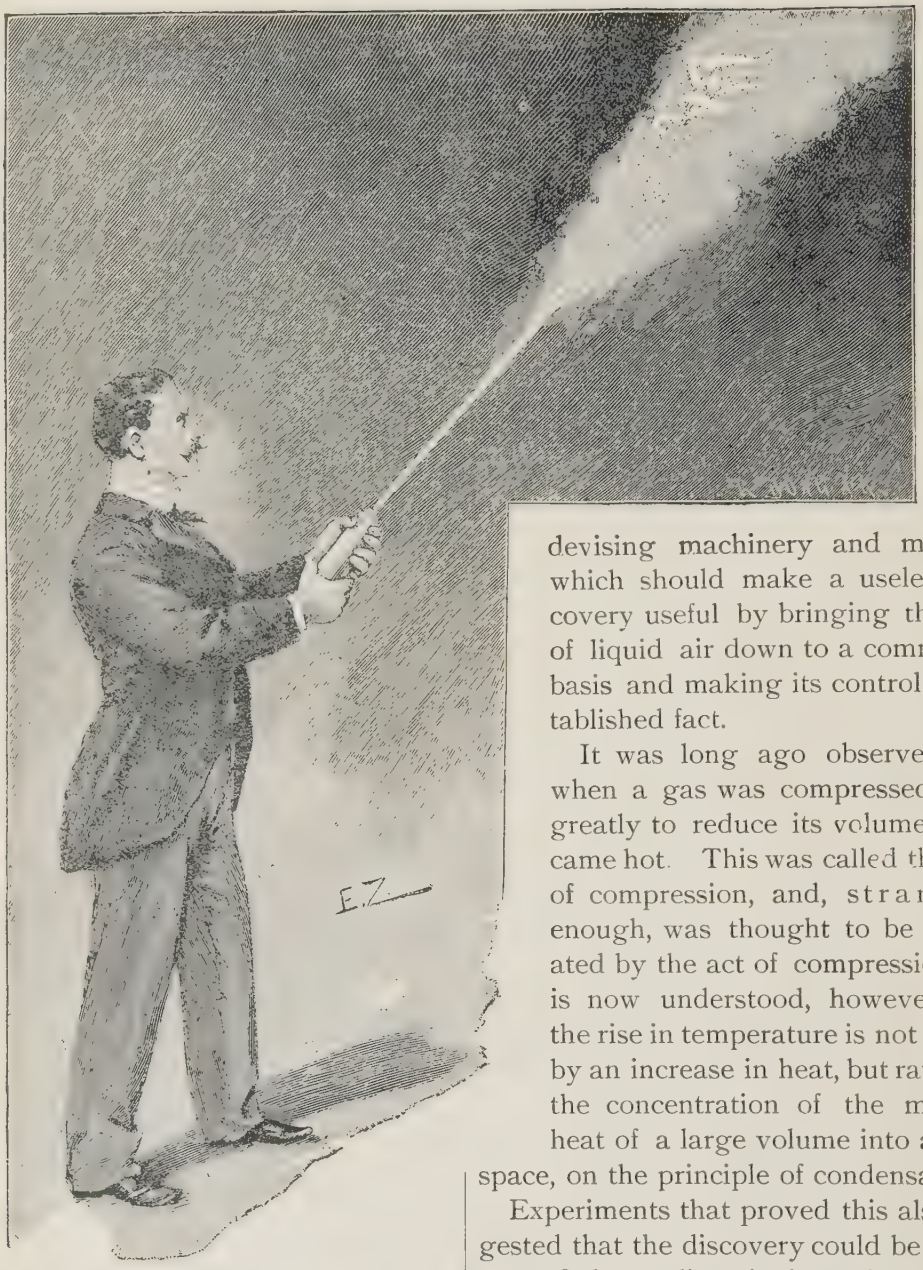
IT is probably a truth without exception that every discovery and every invention since the world began has had its skeptics and its scoffers; no advance in civilization, no improvement or new convenience ever received the approval of a pessimist, or ever will.

There is a difference between the discoverer and the inventor. A scientist seeks the cause of a certain result; when he discovers it other scientists follow it up, study it, experiment with it, merely as a mattter of research, to learn all the phases of the principle in nature which produces this particular effect. Eventually another man, with a different kind of gift, comes along, examines the principle, studies its action, does some more experimenting in his own particular line, thinks of it all his waking hours, dreams of it when asleep, and finally invents a way in which the scientist's discovery may be utilized to the benefit and profit of mankind.

It is almost invariably a long road from the discovery to the invention, and a very silent road, too, as far as the great public is concerned; few know of the labor until success is achieved. Franklin with a kite and key discovered electricity, but it remained for a Morse to build the telegraph, for Cyrus Field to lay the Atlantic cable, for Edison to construct the incandescent burner, and Bell to carry the voice a thousand miles.

Suppose the skeptics and scoffers had prevailed, what would it have benefited mankind to-day that Watt conceived the steam engine, or Morse the telegraph key; that Field knew he could send messages under the ocean; that Edison thought out the arc light, or Bell was positive he could talk over a wire as well as face to face? None of these men received encouragement from the carpers and cynics, who would rather continue to plow with split sticks because their ancestors did. "The thing cannot be done." "The inventors are crazy." "Those who put their money into such Arabian Nights' schemes will lose it," and much more to the same effect. But how those carpers and cynics would be pleased today to have a few shares of stock in the telegraph, the cable, the electric light, or the Bell telephone.

In the early part of the nineteenth century Faraday liquefied chlorin. Over fifty years later Wrobiewsky and Olzewski liquefied air at Cracow, Austria, but their discovery of liquid air availed



SPRAYING LIQUID AIR.

mankind nothing until the inventor had brought to bear upon it his powers of study and concentration, his ingenuity in experiment, and his tireless industry in devising machinery and methods which should make a useless discovery useful by bringing the cost of liquid air down to a commercial basis and making its control an established fact.

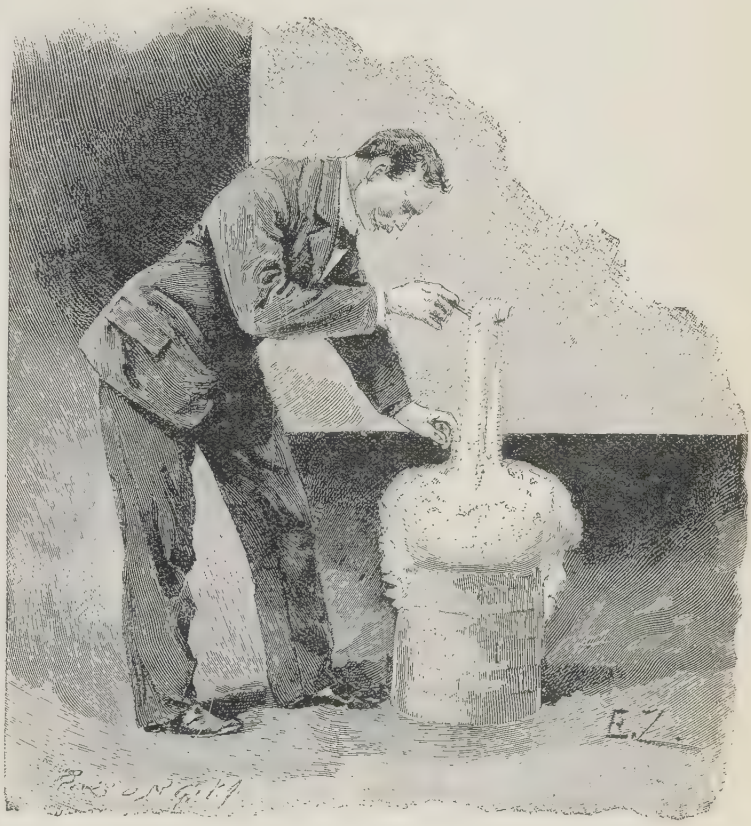
It was long ago observed that when a gas was compressed so as greatly to reduce its volume, it became hot. This was called the heat of compression, and, strangely enough, was thought to be generated by the act of compression. It is now understood, however, that the rise in temperature is not caused by an increase in heat, but rather by the concentration of the manifest heat of a large volume into a small space, on the principle of condensation.

Experiments that proved this also suggested that the discovery could be turned to profit by cooling the heated gas down while under pressure, and then allowing it again to expand to its original volume, which would make it fall greatly in temperature. It was soon learned that gas could be compressed and then cooled and

allowed to expand until its temperature dropped 200 degrees.

For some time it had been held by scientists that air was a permanent gas and could not be changed in its form, but gradually, with experiments, the idea arose that if air could be brought to a sufficiently low temperature, it could be liquefied. All means known were used without success until, in 1877, Raoul Pictet submitted oxygen gas to an enormous pressure combined with intense cold.

The result was a few drops of clear, bluish liquid that bubbled violently for a few moments, and then evaporated into the air again. In 1892, a Polander named Olzewski, already referred to, succeeded in performing a similar experiment with nitrogen, the other constituent of air. And about the same time Professor Dewar, of England, not only performed both of these experiments, but also succeeded in producing a small quantity of air in a mushy form—in fact, air ice.



FILLING A RECEPTACLE WITH LIQUID AIR.

The cost of this first ounce of liquid air was more than $3000. While being a very interesting discovery for laboratory use, such a production and at such an expense was out of the question for commercial purposes. So it remained for Charles E. Tripler, of New York City, to invent a method whereby this wonderful agent can be brought forth with ease and at the cost of about 20 cents a gallon. He saw at once, upon the discovery that air could be liquefied, that it might be a great power generator, and accordingly commenced experiments to simplify the method for procuring it. He investigated the various means by which refrigeration was developed, such as the immense ammonia plants used in breweries and the like. The principle of cooling by expansion, he learned, was the basis to work upon, and the result of his studies was the following system :

At present a fifty-horse power plant

operating an air compressor, and a barrel-like arrangement about fifteen feet high, full of small pipes and valves, and protected by wrappings so as to keep out the heat, are the machines by means of which this new discovery is brought forth. Tripler uses compressed air to cool the other air that he is liquefying. Under the very principle that expanding air grows cooler, if he could so arrange his apparatus that air which was rapidly growing cooler could pass about pipes containing his working material, he would have his problem solved. And so it is.

Heavy Pressure.

Air under a pressure of 2500 pounds to the square inch, and cooled to about 50 degrees Fahrenheit by being passed in pipes through a bath of running water while thus compressed, is carried through coils of pipe to the large felt-and-canvas-covered tube or receiver spoken of. Two sets of pipes lead from the compressor to the receiver: one contains the air to be liquefied, the other the air that does the work of liquefying, but both are under the same heavy pressure, and this is a part of the process.

By turning a tap in the receiver, the air that does the work rushes forth and up the sides and around the pipes in the chimney-like space of the receiver. This reduces the pressure, and since air in expanding takes up heat wherever it can be found, the air confined in the pipes is cooled. As the released air now grows warmer and climbs to the top of the receiver, it gradually returns to the compressor. Here it is again brought under pressure and cooled again, only to be released once more in the receiver to lick up more warmth from the air in the pipes.

Since the temperature of the air under treatment is going down in jumps of 100 degrees every time it is treated to this chilling process, it takes but about fifteen minutes till a tap at the bottom may be turned, and drops of liquid air at the temperature of 312 degrees below zero drip out from the pipes in the receiver. These at once evaporate in great billowy clouds of vapor.

But it is not intended that such an operation shall be devoid of results, so devices have been invented for holding the air after its production. One of these receptacles is the Dewar bulb.

Uses of the Vacuum.

The Dewar bulb consists of two vessels of glass, one within the other, having a high vacuum between the walls, and joined in a common neck at the top. The vacuum prevents the passage of heat, so that the evaporation of the liquid in the inner tube is reduced to a minimum. The neck of the bulb is left open, for liquid air is of such an expanding nature that it would otherwise explode. The cold, heavy mist of evaporation that is always present at the mouth of the bulb acts, however, as a shield to some extent. Dewar tried putting a few drops of mercury between the walls of the two bottles, with the result that in a vacuum the mercury vaporized and spread itself over the walls of the bottles. This acted as a mirror, and still more effectually kept out the heat. Tripler has arranged a set of cans of similar nature, which are covered with felt and canvas so that the liquid air may be shipped. The mouth

of the can is also covered with felt, but this is safe, as it allows the gases to escape somewhat. Air thus packed loses less than one-third in a nine hours' ride.

The uses and experiments to which this wonderful discovery may be placed are as odd and interesting as the method

POURING LIQUID AIR FROM A SPOON.

of its production. The following are a few of its uses:

It is eleven and one-half times as powerful as compressed air, and may be carried in a pasteboard box, while as much energy in compressed air would need the strongest steel cans. It may supplant some forms of fuel, for, when mixed with any form of carbon, it burns rapidly or explodes. Thus it may be used in interior combustion engines—for instance, the gas engine. When a proper motor has been developed, it will no doubt be used to help solve the question of aerial navigation, for something that combines great power with lightness seems to be the only reason why airships are not a complete reality.

The same may be said of submarine navigation. Here liquid air would supply the motive power, and the air for the crew to breathe as well, for a small quantity contains as much air as can be

compressed into many great tanks. Automobiles are now being made to run by this power. Deep-sea diving would also be aided by the use of casks of this air attached to the diving apparatus of the diver, thus doing away in a great measure with the pumps. In mines where water is likely to rush in at any time, it might be used to freeze the surrounding earth, thus preventing great catastrophes. In making such vacuum bulbs as those used for electric lights, liquid air would be very useful. After the air has been pumped out as much as possible, the remainder can be frozen into a solid drop at one end, and then the bulb may be closed above it by an ordinary blow-pipe, thus giving an absolute vacuum.

Frightful Explosives.

The most frightful explosives can be produced with the combination of combustibles and liquid air, for oxygen is necessary to combustion, and this air contains it in vast quantities. Of late months, physicians and surgeons are singing the praises of this discovery, for by its aid a wound may be cauterized, or an excrescence "burned" away entirely. Odd experiments, such as freezing a rose in all its color and loveliness, or reducing an egg to a frozen solid that when handled will break up into a thousand fragments and the yolk scatter as the pollen of a flower, show what may be done in the laboratory.

The first automobile in the world to be run successfully by liquid air was exhibited in Boston. The test was made in the presence of a number of officials and stockholders of the Liquid Air and Power Company, and the automobile acted to the thorough satisfaction of everybody.

Mr. Hans Knudsen, one of the inventors of the company's method of making liquid air, operated the automobile, and Mr. George A. Osgood, superintendent of the automobile department of the company, personally supervised the test.

The automobile is a type of runabout, with a black body and dark red trimmings, and pneumatic tires. Its appearance is both neat and stylish. The automobile acted quickly, and ran swiftly and smoothly. There was neither the smell of gasolene motor nor the noise of the electric motor. The new steering gear showed itself decidedly practicable and efficient. The response to the power lever was almost instant, and starts and stops were made easily and quickly.

The liquid air was contained in an insulated tank placed in the box behind the seat, where it is easily and conveniently reached. The motor met the highest expectations of the inventors and the officers of the company.

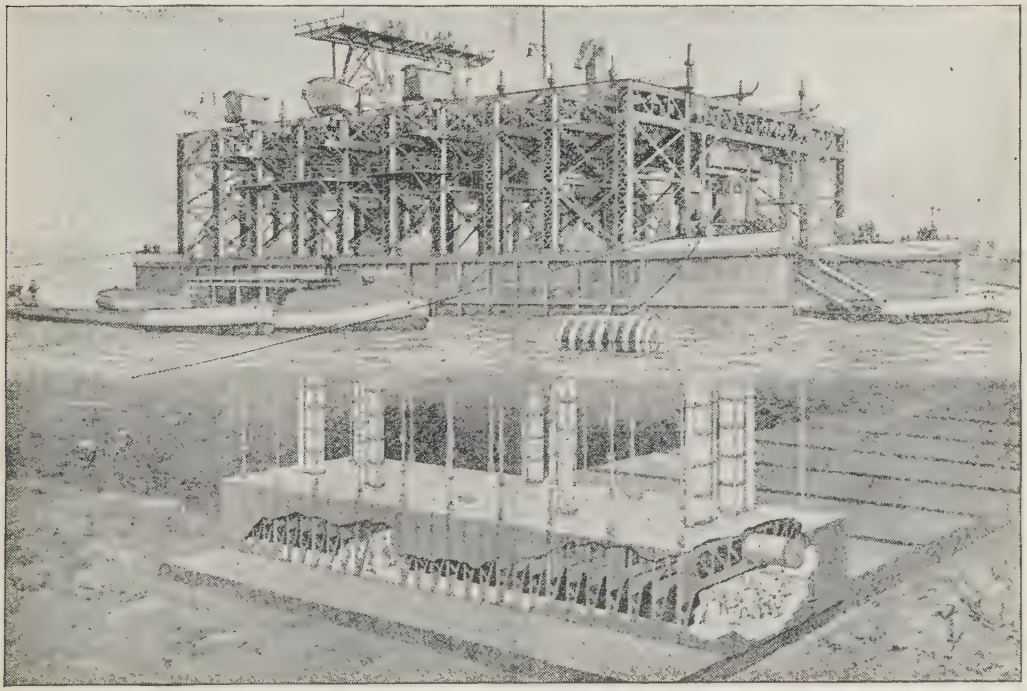
Applied to Machinery.

For a long time it was supposed that steam was about the only motive power that could be used to advantage. It required as a rule heavy machinery, and the expense has always been an important item. Large quantities of fuel must be used in the production of steam. The amount of coal burned on the railroads of our country is enormous. Then came electricity as a motive power, and rapidly it grew to be a rival of steam.

But the advocates of liquid air believe they see large possibilities in this substance.

FAMOUS DRYDOCK AND SUBMARINE WOKRSHOP

A NOVEL dry-dock has been built at Kiel, Germany, which is constructed in a very ingenious manner. In order that the earth and cement work at the bottom of the dock might be made solid and permanent, without interference from the water, the engineers constructed a kind of submarine workshop at a cost of $240,000, and in regard to its size and degree of safety, it is unique.



NOVEL DRY-DOCK AND SUBMARINE WORKSHOP.

It is shaped something like a large box, being nearly 126 feet long and 42 feet wide, and covers a space of over 5,000 square feet. When the earth, cement, etc., were built up in a layer about 3 feet in height, the workshop was raised, and its position moved where its further operation was necessary.

The workshop is 15 feet high, and is divided in the middle by a horizontal sheet-iron wall, the upper part being the so-called buoy. A ballast cylinder run-

ning through the lower part gives it stability. The latter as well as the buoy are filled with water. When the shop is to be floated, the ballast cylinder is emptied and the whole arrangement floats. The place of work on this underground shop is about 8 feet high, and the water is kept out by means of compressed air.

Seven shafts lead to the surface, two of which are for the use of the men, one for bringing down the earth, etc., and four for materials. All are operated by compressed air.

On the surface is the supply float, looking much like a canal boat, on which there is a big derrick that raises the workshop out of the water when necessary, and also has machinery for the mixing of the mortar and other materials used for building.

There is also an arrangement by which the mortar, after being mixed, is put into a slanting gutter, where it glides into the opening of the shaft leading down to the room below. The entire power necessary for the working of the machinery comes from a power house situated in the vicinity on land.

GREAT INSTITUTION OF LEARNING

Ten Million Dollars Given by Andrew Carnegie for Higher Education—University to be Established at Washington.

AT Washington, on January 29, 1902, Andrew Carnegie presented to the trustees of the Carnegie Institute a deed conveying $10,000,000 in bonds of the United States Steel Corporation with which to establish and maintain the great project for higher education and advanced research, to which his name has been given. Mr. Carnegie made an address, in the course of which, he said:

"My first thought was to fulfil the express wish of Washington by establishing a university here, but a study of the question forced me to the conclusion that under present conditions were Washington still with us, his finely balanced judgment would decide that in our generation at least, such use of wealth would not be the best. One of the most serious objections, and one which I could not overcome, was that another university might tend to weaken existing universities.

"My desire was to co-operate with all educational institutions and establish what would be a source of strength and not of weakness to them, and the idea of a Washington university, or anything of a memorial character, was therefore abandoned. It cost some effort to push aside the idea of a Washington university founded by Andrew Carnegie, which the president of the Woman's George Washington Memorial Association was kind enough to suggest. That may be re-

served for another in the future, for the realization of Washington's desire would perhaps justify the linking of another name with his, but certainly nothing else would.

"This gift of the donor has no pretensions to such honor, and in no wise interferes with the proposed university or with any memorial. It has its own more modest field and is intended to co-operate with all kindred institutions, including the Washington university, if ever built. In this hope, I think the name should be sacredly held in reserve.

"It is not a matter of one million, or ten millions, or even of twenty millions, but of more to fulfil worthily the wish of Washington, and I think no one would presume to use that almost sacred name except for a university of the very first rank, established by national authority as he desired. Be it our part in our day and generation to do what we can to extend the boundaries of human knowledge."

Mr. Carnegie's Statement.

Official announcement was made at Washington, January 9, of the incorporation of the Carnegie Institution, to control and administer the $10,000,000 gift of Andrew Carnegie. The only indication as to the form of the gift was that it would be in "5 per cent. bonds." The announcement was made in the form of a statement given out in accordance with the expressed wish of Mr. Carnegie. The statement says:

"In the development of his plans, Mr. Carnegie has consulted with a number of gentlemen in different parts of the country, including the heads of universities and other scientific institutions, and particularly with Abram S. Hewitt, Dr. Daniel C. Gilman, Dr. John S. Billings, Dr. Charles D. Walcott, and Carroll D. Wright."

The Board of Trustees elected by the incorporators to carry out the purposes of the Institution as indicated is as follows: Ex-Officio members—The President of the United States; The President of the Senate; The Speaker of the House of Representatives; The Secretary of the Smithsonian Institution; The President of the National Academy of Sciences. Selected Members—Grover Cleveland, New Jersey; John S. Billings, New York; William N. Frew, Pennsylvania; Lyman J. Gage, Illinois; Daniel C. Gilman, Maryland; John Hay, District of Columbia; Abram S. Hewitt, New Jersey; Henry L. Higginson, Massachusetts; Henry Hitchcock, Missouri; Charles L. Hutchinson, Illinois; William Lindsay, Kentucky; Seth Low, New York; Wayne MacVeagh, Pennsylvania; D. O. Mills, California; S. Weir Mitchell, Pennsylvania; W. W. Morrow, California; Elihu Root, New York; John C. Spooner, Wisconsin; Andrew D. White, New York; Edward D. White, Louisiana; Charles D. Walcott, District of Columbia, and Carroll D. Wright, District of Columbia.

Object of the Institution.

Mr. Carnegie's purpose, as stated by himself in requesting the various trustees to become members of the board, is as follows:

"It is proposed to found in the City of Washington, in the spirit of Washington, an institution which, with the co-opera-

tion of institutions now or hereafter established there or elsewhere, shall, in the broadest and most liberal manner, encourage investigation, research and discovery; encourage the application of knowledge to the improvement of mankind; provide such buildings, laboratories, books, and apparatus as may be needed, and afford instruction of an advanced character to students whenever and wherever found, inside or outside of schools, properly qualified to profit thereby.

"Among its aims are these:

"To increase the efficiency of the universities and other institutions of learning throughout the country by utilizing and adding to their existing facilities and by aiding teachers in the various institutions for experimental and other work on these institutions as far as may be advisable.

The Specialist.

"To discover the exceptional man in every department of study, whenever and wherever found, and enable him by financial aid to make the work for which he seems specially designed his life work.

"To promote original research, paying great attention thereto, as being one of the chief purposes of this institution.

"To increase facilities for higher education.

"To enable such students as may find Washington the best point for their special studies to avail themselves of such advantages as may be open to them in the museums, libraries, laboratories, observatory, meteorological, piscicultural, and forestry schools and kindred institutions of the several departments of the Government.

"To insure the prompt publication and distribution of the results of scientific investigation, a field considered to be highly important.

"These and kindred objects may be attained by providing the necessary apparatus for experimental work, by employing able teachers from the various institutions in Washington or elsewhere, and by enabling men fitted for special work to devote themselves to it through salaried fellowships or scholarships or through salaries with or without pensions in old age, or through aid in other forms to such men as continue their special work at seats of learning throughout the world.

For Higher Education.

"As we have before stated, the Carnegie Institution is not a university. The radical difference between a university and the work of research provided for in the Carnegie plan is that the former must be situated at one place, and must use a large part of its funds for installation, and then must devote another large part to teaching that which can be obtained as well from other sources. The latter can be prosecuted in any part of the country where the conditions are most favorable; it requires relatively an inexpensive "plant," and the funds designed for it can be devoted wholly to it, while the results cannot be secured in any other way."

For a long time the young men of our country have been in the habit of going abroad to finish their studies and complete their education. Our great institutions of learning, now multiplying rapidly, will soon render this entirely unnecessary.

MAMMOTH TREE GROVE

Astounding Size and Height of the Giants of the Forest in California—Story of a Trip to Calaveras County.

AMONG the wonders of nature, among what may be called the miracles of the vegetable kingdom, the immense trees of California hold a prominent place. The following vivid and interesting account of a trip to Calaveras County in the central part of the State furnishes an accurate idea of the marvelous growths found in this famous locality.

Leaving the mining town of Murphy's Camp behind, we cross the "Flat," and—about half a mile from town—proceed, upon a good carriage road, up a narrow canyon, now upon this side of the stream, and now on that, as the hills proved favorable, or otherwise, for the construction of the road. If our visit is supposed to be in spring or early summer, every mountain side, even to the tops of the ridges, is covered with flowers and flowering-shrubs of great variety and beauty; while, on either hand, groves of oak and pines stand as shade-giving guardians of personal comfort to the dust-covered traveler on a sunny day.

As we continue our ascent for a few miles, the road becomes more undulating and gradual, and lying, for the most part, on the top, or gently sloping sides, of a dividing ridge; often through dense forests of tall, magnificent pines, that are from one hundred and seventy to two hundred and twenty feet in height.

We measured one, that had fallen, that was twenty inches in diameter at the base, and fourteen and a half inches in diameter at the distance of one hundred and twenty-five feet from the base. The ridges being nearly clear of an undergrowth of shrubbery, and the trunks of the trees, for fifty feet upward, or more, entirely clear of branches, the eye of the traveler can wander, delightedly, for a long distance, among the captivating scenes of the forest.

At different distances upon the route, the canal of the Union Water Company winds its sinuous way on the top or around the sides of the ridge; or its sparkling contents rush impetuously down the water-furrowed centre of a ravine. Here and there an aqueduct, or cabin, or sawmill, gives variety to an ever-changing landscape.

When within about four and a half miles of the Mammoth-Tree Grove, the surrounding mountain peaks and ridges are boldly visible. Looking southeast, the uncovered head of Bald Mountain silently announces its solitude and distinctiveness; west, the "Coast Mountain range" forms a continuous girdle to the horizon, extending to the north and east, where the snowy tops of the Sierras form a magnificent background to the glorious picture.

While we have been thus riding and admiring, and talking and wondering, and musing concerning the beautiful scenes we have witnessed, the deepening shadows of the densely-timbered forest we are entering, by the awe they inspire—at first gently and imperceptibly, then rapidly and almost to be felt—prepare our minds to appreciate the imposing grandeur of the objects we are about to see, just as

"Coming events cast their shadows before."

"WAROONA," 28 FEET IN DIAMETER, 275 FEET HIGH,
MARIPOSA GROVE, CALIFORNIA.

The gracefully-curling smoke from the chimneys of the Big-Tree Cottage, that is now visible; the inviting refreshment of the inner man; the luxurious feeling arising from bathing the hands and temples in cold, clear water—especially after a ride or walk—are alike disregarded. One thought, one feeling, one emotion—that of vastness, sublimity, profoundness, pervades the whole soul; for there

Giant Pillars.

"The giant trees, in silent majesty,
Like pillars stand 'neath Heaven's mighty dome.
'Twould seem that, perch'd upon their topmost branch,
With outstretch'd finger, man might touch the stars;
Yet, could he gain that height, the boundless sky
Were still as far beyond his utmost reach,
As from the burrowing toilers in the mine.
Their age unknown, into what depths of time
Might Fancy wander sportively, and deem
Some Monarch-Father of this grove set forth
His tiny shoot, when the primeval flood
Receded from the old and changed earth;
Perhaps, coeval with Assyrian kings,
His branches in dominion spread; from age
To age, his sapling heirs with empires grew.
When Time those patriarchs' leafy tresses strew'd
Upon the earth, while Art and Science slept,
And ruthless hordes drove back Improvement's stream,
Their sturdy oaklings throve, and, in their turn,
Rose, when Columbus gave to Spain a world.
How many races, savage or refined,
Have dwelt beneath their shelter! Who shall say
(If hands irreverent molest them not)
But they may shadow mighty cities, reared
E'en at their roots, in centuries to come,
Till, with the 'Everlasting Hills' they bow,
When 'Time shall be no longer!'"

Before wandering further amid the wild secluded depths of this forest, it will be well that the horse and his rider should partake of some good and substantial repast, such as he will here find provided, inasmuch as it is not always wisest or best to explore the wonderful, or look upon the beautiful, with an empty stomach, especially after a bracing and appetitive ride of fifteen miles. While thus engaged, let us explain some matters that we have reserved for this occasion.

Where Located.

The Mammoth-Tree Grove, then, is situated in a gently sloping and heavily timbered valley, on the divide or ridge between the San Antonio branch of the Calaveras River and the north Fork of the Stanislaus River, at an elevation of 2300 feet above Murphy's Camp and 4370 feet above the level of the sea; at a distance of ninety-seven miles from Sacramento City and eighty-seven from Stockton.

When specimens of this tree, with its cones and foliage, were sent to England for examination, Professor Lindley, an eminent English botanist, considered it as forming a new genus, and accordingly named it (doubtless with the best intention, but still unfairly) "Wellingtonia gigantea," but through the examinations of Mr. Lobb, a gentleman of rare botanical attainments, who has spent several years in California, devoting himself to this interesting, and, to him, favorite branch of study, it is decided to belong to the Taxodium family, and must be referred to the old genus "Sequoia sempervirens"; and, consequently, as it is not a new genus, and as it has been properly examined and classified, it is now known only among scientific men as the "Sequoia gigantea," and not "Wellingtonia," or, as some good and laudably patriotic souls

would have it, to prevent the English from stealing American thunder, "Washingtonia gigantea."

Within an area of fifty acres there are one hundred and three trees of a goodly size, twenty of which exceed twenty-five feet in diameter at the base, and, consequently, are about seventy-five feet in circumference.

Dancing on a Stump.

But, the repast over, let us first walk upon the "Big-Tree Stump" adjoining the cottage. You see it is perfectly smooth, sound and level. Upon this stump, however incredible it may seem, on the Fourth of July, thirty-two persons were engaged in dancing four sets of cotillions at one time, without suffering any inconvenience whatever; and besides these, there were musicians and lookers-on. The solid wood across this stump, five and a half feet from the ground (now the bark is removed, which was from fifteen to eighteen inches in thickness), measures twenty-five feet, and with the bark, twenty-eight feet. Think for a moment, the stump of a tree exceeding nine yards in diameter, and sound to the very centre.

This tree employed five men for twenty-two days in felling it—not by chopping it down, but by boring it off with pump augurs. After the stem was fairly severed from the stump, the uprightness of the tree, and breadth of its base, sustained it in its position. To accomplish the feat of throwing it over, about two and a half days of the twenty-two were spent in inserting wedges and driving them in with the butts of trees, until, at last, the noble monarch of the forest was forced to tremble, and then to fall, after braving "the battle and the breeze" of nearly three thousand winters.

In our estimation, it was a sacrilegious act; although it is possible that the exhibition of the bark among the unbelievers of the eastern part of our continent and of Europe, may have convinced all the "Thomases" living that we have great facts in California that must be believed sooner or later. This is the only palliating consideration with us for this act of desecration.

This noble tree was three hundred and two feet in height, and ninety-six feet in circumference at the ground. Upon the upper part of the prostrate trunk is constructed a long double bowling-alley, where the athletic sport of playing bowls may afford a pastime and change to the visitor.

Largest Tree Standing.

Now, let us walk among the giant shadows of the forest, to another of these wonders—the largest tree now standing; which, from its immense size, two breast-like protuberances on one side, and the number of small trees of the same class adjacent, has been named "The Mother of the Forest." In the summer of 1854, the bark was stripped from this tree by Mr. George Gale, for purposes of exhibition in the East, to the height of one hundred and sixteen feet; and it now measures in circumference, without the bark, at the base, eighty-four feet; twenty feet from base, sixty-nine feet; seventy feet from base, forty-three feet six inches; one hundred and sixteen feet from base, and up to the bark, thirty-nine feet six inches.

The full circumference at base; including bark, was ninety feet. Its height is three hundred and twenty-one feet. The average thickness of bark was eleven inches, although in places it was about two feet. This tree is estimated to contain five hundred and thirty-seven thousand feet of sound inch lumber. To the first branch it is one hundred and thirty-seven feet. The small black marks upon the tree indicate points where two and a half inch augur holes were bored, into which rounds were inserted, by which to ascend and descend, while removing the bark.

Names of Visitors.

At different distances upward, especially at the top, numerous dates and names of visitors have been cut. When the bark was being removed, a young man fell from the scaffolding—or, rather, from a descending noose—at a distance of seventy-nine feet from the ground, and escaped with a broken limb. We were within a few yards of him when he fell, and were agreeably surprised to discover that he had not broken his neck.

A short distance from the above lies the prostrate and majestic body of the "Father of the Forest," the largest tree of the entire group, half buried in the soil. This tree measures in circumference, at the roots, one hundred and ten feet. It is two hundred feet to the first branch; the whole of which is hollow, and through which a person can walk erect. By the trees that were broken off when this tree bowed its proud head, in its fall, it is estimated that, when standing, it could not be less than four hundred and thirty-five feet in height. Three hundred feet from the roots, where it was broken off by striking against another large tree, it is eighteen feet in diameter.

Around this tree stand the graceful, yet giant trunks of numerous other trees, which form a family circle, and make this the most imposing scene in the whole grove. From its immense size, and the number of trees near, doubtless originated the name. Near its base is a never-failing spring of cold and delicious water.

Let us not linger here too long, but pass on to "The Husband and Wife"—a graceful pair of trees that are leaning, with apparent affection, against each other. Both of these are of the same size, and measure in circumference, at the base about sixty feet; and in height are about two hundred and fifty-two feet.

Sixty Feet on Horseback.

A short distance further is "The Burnt Tree;" which is prostrate, and hollow from numerous burnings—in which a person can ride on horseback for sixty feet. The estimated height of this tree, when standing, was three hundred and thirty feet and its circumference ninety-seven feet. It now measures across the roots thirty-nine feet six inches.

"Hercules," another of these giants, is ninety-five feet in circumference, and three hundred and twenty feet high. The "Hermit," a lonely old fellow, is three hundred and eigteen feet in height, and sixty in circumference; exceedingly straight and well formed.

The "Old Maid"—a stooping, broken-topped, and forlorn-looking spinster of big-tree family—is two hundred and sixty-one feet in height, and fifty-nine feet in circumference.

As a fit companion to the above, though

at a respectful distance from it, stands the dejected-looking "Old Bachelor." This tree, as lonely and as solitary as the former, is one of the roughest, bark-rent specimens of the big trees to be found. In size it rather has the advantage of the "Old Maid," being about two hundred and ninety-eight feet in height, and sixty feet in circumference.

Near to the "Old Bachelor" is the

STUMP OF A MONSTER TREE OF THE SIERRAS.

"Pioneer's Cabin," the top of which is broken off about one hundred and fifty feet from the ground. The tree measures thirty-three feet in diameter; but, as it is hollow, and uneven in its circumference, its average size will not be quite equal to that.

The "Siamese Twins," as their name indicates, with one stem at the ground, form double tree about forty-one feet upward. These are each three hundred feet in height.

Near to them stands the "Guardian," a fine-looking old tree, three hundred and twenty feet in height, by eighty-one feet in circumference.

The "Mother and Son" form another beautiful sight, as side by side they stand. The former is three hundred and fifteen feet in height, and the latter three hundred and two feet. Unitedly, their circumference is ninety-three feet.

The "Horseback Ride" is an old, broken, and long prostrate trunk, one hundred and fifty feet in length, hollow from one end to the other, and in which, to the distance of seventy-two feet, a person can ride on horseback. At the narrowest place inside, this tree is twelve feet high.

"Uncle Tom's Cabin" is another fanciful name, given to a tree that is hollow, and in which twenty-five persons can be seated comfortably (not, as a friend at our elbow suggests, in each other's laps, perhaps). This tree is three hundred and five feet in height, and ninety-one feet in circumference.

The "Pride of the Forest" is one of the most beautiful trees of this wonderful grove. It is well-shaped, straight, and sound; and, although not quite as large as some of the others, it is, nevertheless, a noble-looking member of the grove, two hundred and seventy-five feet in height, and sixty feet in circumference.

The "Two Guardsmen" stand by the roadside, at the entrance of the "clearing," and near the cottage. They seem to be

the sentinels of the valley. In height these are three hundred feet; and in circumference, one is sixty-five feet, and the other sixty-nine feet.

Next—though last in being mentioned, not least in gracefulness and beauty—stand the "Three Sisters"—by some called the "Three Graces"—one of the most beautiful groups (if not the most beautiful) of the whole grove. Together, at their base, they measure in circumference ninety-two feet; and in height they are nearly equal, and each measures nearly two hundred and ninety-five feet.

Many of the largest of these trees have been deformed and otherwise injured, by the numerous and large fires that have swept with desolating fury over this forest, at different periods. But a small portion of decayed timber, of the Taxodium genus, can be seen. Like other varieties of the same species, it is less subject to decay, even when fallen and dead, than other woods.

Three Thousand Years Old.

Respecting the age of this grove, there has been but one opinion among the best informed botanists, which is this—that each concentric circle is the growth of one year; and as nearly three thousand concentric circles can be counted in the stump of the fallen tree, it is correct to conclude that these trees are nearly three thousand years old. "This," says the "Gardener's Calendar," "may very well be true, if it does not grow above two inches in diameter in twenty years, which we believe to be the fact."

Could those magnificent and venerable forest giants of Calaveras county be gifted with a descriptive historical tongue, how their recital would startle us, as they told of the many wonderful changes that have taken place in California within the last three thousand years!

Famous "South Grove."

Almost eight miles from Calaveras Grove is the wonderful "South Grove," by far the largest and finest grove yet discovered in California. It contains 1380 trees, many of them of the most magnificent proportions. We measured ten trees that were twenty-one feet larger in circumference than any others in either of the groves. Through the prostrate trunk of one tree, resembling an immense tube, we could have driven one of the heaviest Concord stages, crowded with passengers, a distance of 200 feet. The trip can be made there and back in one day from the Calaveras Grove.

We are among the most marvelous scenes on the American continent, and that is saying much, for everywhere our country is replete with wonders that challenge astonishment and admiration.

"Nature—faint emblem of Omnipotence!
Shaped by His hand—the shadow of His light;
The veil in which He wraps His majesty,
And through whose mantling folds He deigns to show,
Of His mysterious, awful attributes
And dazzling splendors, all man's feeble thought
Can grasp uncrushed, or vision bear unquenched."

After the visitor has lingered long among the scenes we have just described, he will feel that he

"Could pass days
Stretched in the shade of those old cedar trees,
Watching the sunshine like a blessing fall—
The breeze like music wandering o'er the boughs,
Each tree a natural harp—each different leaf
A different note, blent in one vast thanksgiving."

BREAKWATERS

Devices for Keeping Back the Water and Saving Vessels and Piers from Damage.

BREAKWATERS differ from piers in their not being necessarily adapted for commercial purposes. They do not, therefore, require to have roadways for the accommodation of traffic, or parapets for keeping water or spray from passing over them. Breakwaters are artificial structures consisting generally of stones or blocks of concrete, built or deposited in deep water. Their object is to tranquillize those portions of the sea which they cover, and which thus become sheltered anchorages.

BREAKWATER AND INTERIOR COVE FOR THE SAFETY OF SHIPS.

They may be divided into three classes: 1. Vertical or nearly vertical structures of built masonry for arresting the onshore progress of the waves, and for either reflecting them seawards or deflecting them laterally. 2. Sloping structures of rubble stones dropped into

the sea from timber stages or floating barges, having a sloping face on each side. These slopes, which, after the blocks have been consolidated are generally protected above low water by stones set closely together, are the angles of repose assumed by the loose blocks under the influence of the waves, and vary in steepness from above high water to below low water, where the force of waves is least. They vary from about one foot horizontal to one foot vertical to seven feet horizontal to one foot vertical. 3. What may be termed composite breakwaters are partly sloping and partly vertical, and act by causing the waves to break, and also by partially reflecting them seawards or deflecting them laterally. Breakwaters, though passive, are nevertheless real agents by which work is done in combating the waves in one or other of the three modes which have been defined.

Artificial Harbors.

With the birth of commerce and naval warfare, in the earliest ages of civilization, arose the necessity for artificial harbors. The Phœnicians, the fathers of navigation, soon set to work to protect their scanty strip of Levantine coast. At Tyre two harbors were formed, to the north and to the south of the peninsula on which the city was placed. At Sidon similar but less expensive works long testified to the wealth and engineering genius of the Phœnicians. The breakwaters were principally constructed of loose rubble.

Carthage, is another part of the Mediterranean, also possessed a harbor, in two divisions, formed by moles, and connected with one another by a canal 70 feet wide. On the inner harbor stood the arsenals, with room around them for 200 warships. Still keeping to the great inland sea, we come to Greece; but here nature has provided so many navigable inlets that little remained to be done by man.

Coasts of Italy.

Nevertheless, some minor works were executed at Piræus and elsewhere, chiefly, of course, for warlike purposes. The Romans, finding ships necessary to the dominion of the world, set about constructing harbors for them, in their usual solid and workmanlike manner. The coasts of Italy still show how well they understood both the principles and the practice of this branch of marine engineering.

The introduction of concrete, made from Portland cement, has in recent years greatly modified and simplified the construction of breakwaters. The cement is mixed with sand, gravel and broken stone in various proportions, according to exposure—1 of cement to 7 of other materials being a common proportion for breakwaters. Sometimes the concrete is made into large blocks on shore and deposited under water. On the other hand, it may be lowered down, inclosed in large bags; or it may be lowered down in boxes, with hinged bottoms, and deposited in mass on the bottom, either within timber casing, or even without any protection at all. The south breakwater of Aberdeen is formed of large blocks from the bottom up to 4 feet above low water, and above that level of concrete in mass formed within temporary casing.

GREAT FISHING INDUSTRY

Harvest of the Sea—Immense Food Supplies Captured With the Hook and Net.

IN almost every part of the world, fishes form some portion of the food of mankind, but they form a much more important part of the food-supply in the northern temperate regions than in the tropics or the southern hemisphere, and they are obtained in enormously greater abundance from the sea than from inland fresh waters. Hence, it has become customary by a metaphor to speak of the "harvest of the sea."

It is only within the last century, if we except the fish-ponds of the medieval monasteries and the culture of fresh water fishes in China, that attempts have been made to control the conditions under which valuable fishes live and multiply. It is impossible in most cases to feed and protect aquatic animals with the same completeness as domesticated land animals. The cultivation of the former consists chiefly in artificially securing the production of large numbers of young, then setting them at liberty, and endeavoring to promote an abundant supply of their natural food, to destroy their enemies, and remove all unfavorable conditions.

In this way the supply of salmon and some other fish and of oysters has been in some places largely increased—oysters especially in France and Holland, salmon and other fish chiefly in the United States. But no exclusively marine species has yet been successfully cultivated on a scale large enough to be of practical importance, and it is still an open question whether scientific methods can be applied to increase the supply of valuable marine fish diminished by excessive fishing.

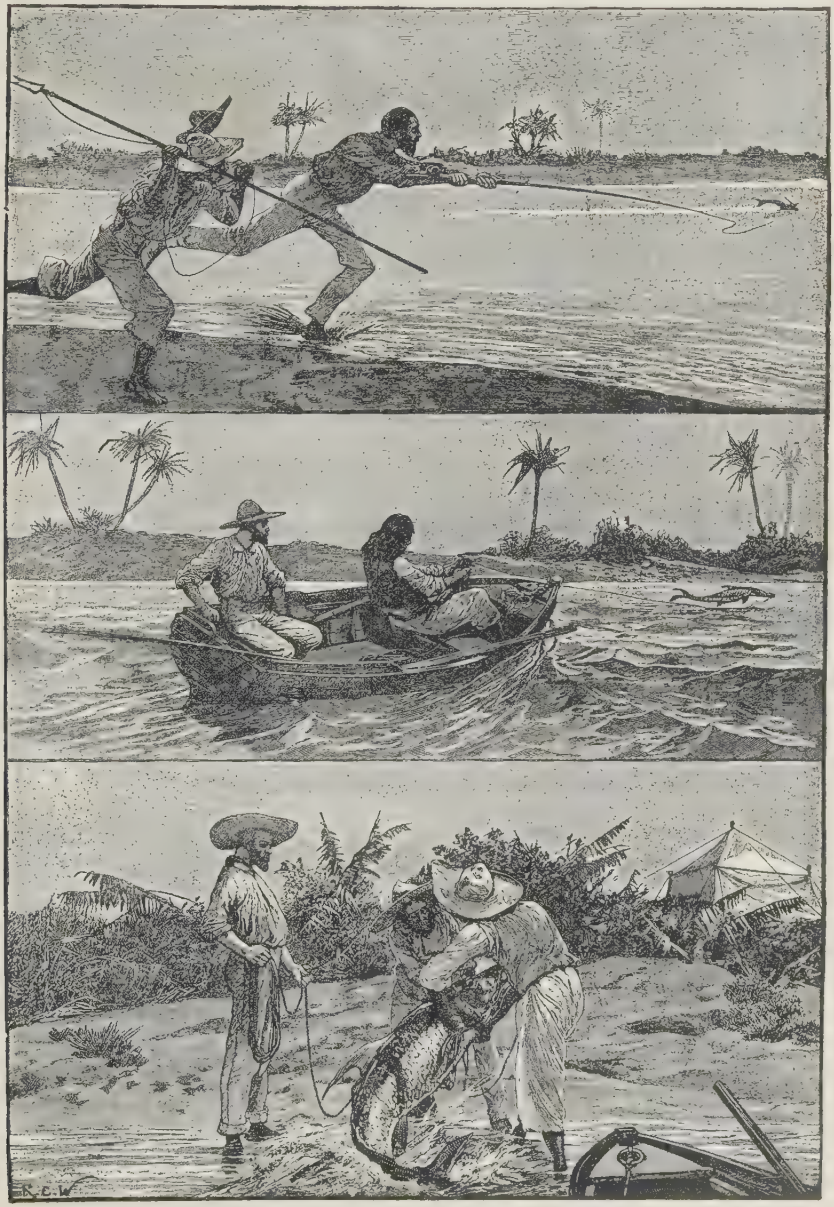
But although marine fishes are produced in enormous abundance without human aid or foresight, the amount of labor and capital required to capture them is very large. Sea-going vessels and boats are themselves costly machines, and the other elaborate and expensive machinery has to be carried and worked on board of them; the vessels and gear have to sustain very hard wear; both are frequently damaged, the gear being often, and vessels sometimes, lost altogether.

The capture of fish and their consumption have enormously increased in Europe and North America, since the beginning of the age of steam. This increase is due to the great increase of population, and the consequently increased demand for cheap and palatable food, and to the facility afforded by the railways for conveying fresh fish to the large inland towns.

Nearly all the abundant marine fish on the coasts of Europe and North America are valuable as food, some being held in great estimation as delicacies by the rich, others forming a staple food of the poor. The chief exceptions are the dog-fishes,

which are extremely abundant and at the same time of no value as food, although they are occasionally eaten in some places on the coast.

The other most valuable marine animals on the European coasts are the lobster, crab, crayfish, shrimps, and prawns among Crustacea, and certain molluscs, chiefly the oyster, though mussels, clams or scallops, and welks are of



TARPON FISHING IN A FLORIDA RIVER.

some value. Except in extensive fresh-water lakes, true fresh-water fishes are of minor importance, but there are several valuable fish which ascend rivers to a greater or less distance. The most important of these are the salmon and sea-trout, but the smelt and shad are abundant in some estuaries of Europe, and other species of shad are abundant and highly valuable in America. Eels are also largely eaten in Europe, and the sturgeon, though rare in Britain, is abundant in some large rivers of the Continent. These are among the principal fish that are relished for food.

Our illustration shows fishermen in Florida capturing the tarpon. At certain seasons of the year this fish is abundant, and as its commercial value is considerable the taking of it constitutes an important industry. It requires a good deal of skill to land the tarpon; it is a game fish and very active. The fishermen often are compelled to jump into the water in order to give the fish the length of the line so that it may not be broken. The three parts of our illustration furnish a very good idea of the experiences of those engaged in this industry.

FAMOUS YACHTS AND RACES

Great Anglo-American Contest—Struggle Between the Columbia and Shamrock II—Races Reported by Wireless Telegraphy.

UP to 1887 the races for the cup were sailed over the inside or New York course. Since that year, when "Volunteer" defeated the Scots cutter, "Thistle," the races have been held on the course off Sandy Hook. This course is here shown in bird's-eye view, the course being either a triangular one with ten miles to each side of the triangle or a straight course of fifteen miles out and fifteen miles back.

The "get ready" gun is fired at 10.50 A.M., and the starting gun at 11. Both yachts jockey up and down the line in order to save a second or two in crossing. The outward run usually means a series of tacks against the wind, during which the yachts keep fairly close together, but they may beat off separately to right and left as it pleases them. After rounding the buoy and with the wind blowing direct for home, or dying down, the yachts are apt to get separated.

The flags shown here are those of the "Shamrock" and the Royal Ulster Yacht Club to the left, the New York Yacht Club and the flagship "Corona," to the right. The hand which appears on the Royal Ulster Yacht Club flag in the left-hand bottom corner, is the red hand of Ulster. The tradition runs that three Irish princes once sought the hand of the beautiful daughter of old King Muredach. The daughter sat on one throne with an

empty one beside her; the three knights had to row up an estuary, and the first to reach the throne was to secure it and his bride. The golden-locked Eochy was young, and as the barges drew near seemed beaten, but seizing his shining sword he lopped off his left hand and flung it far over the water to the princess's feet. "Bow to Eochy, King of Uladh," shouted the assembled Druids.

The much-coveted America cup for which the yachts of two branches of the Anglo-Saxon family have been struggling, is not a thing of beauty or costliness in itself. Its actual value is about $85. As a work of art its value is a minus quantity. The ill-shaped bulges in the body of the vessel are rivalled in ugliness by the snouty lip which has given American cartoonists the opportunity of producing some very clever cup caricatures. Strange to say, the cup is really not a cup at all, being made only for show—it has no bottom. Once in a moment of great excitement some wine was poured into it, with the result that the tablecloth was flooded with claret.

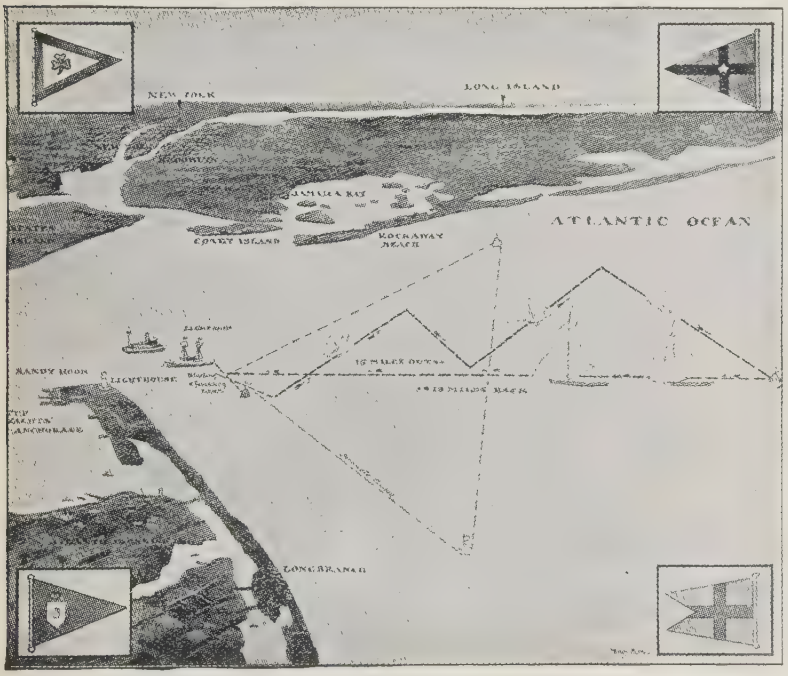


DIAGRAM SHOWING THE COURSE OVER WHICH THE YACHTS SAILED IN THE AMERICA CUP CONTEST.

Winning the Cup.

The cup was won from England by the two-masted yacht "America," in a race in the Solent in 1851. There were fifteen other racers of various nationalities. When the cup was taken to America it was announced as an international trophy, and at varying intervals attempts to regain it have been made by Canada and England.

The modern yacht is very different from the "America." The up-to-date "skimming dish" is very broad in the beam, that is across the middle, and very shallow in draught, but for the great bulb-fin keel weighted with a mass of lead. The body of the yacht acts as a pivot to a bar, the wind pressing at one end and the heavy lead counterbalancing at the other.

The "Shamrock" appears black, the "Columbia" grey. "Shamrock II." is slightly larger than "Columbia" and consequently had to give a time allow-

ance as is the custom in yacht racing, when one boat is bigger than another. In the great race in 1901 it was 43 seconds, and consequently "Shamrock II." had to get home more than 43 seconds ahead of her rival in order to win. This she failed to do, although she was a marvelously fast craft and a very formidable rival to her American antagonist.

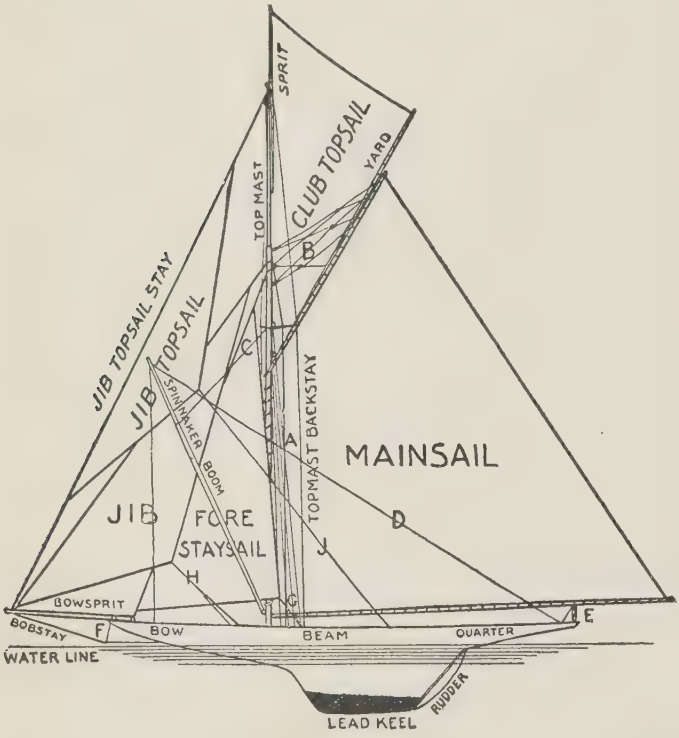


DIAGRAM OF RACING YACHT, NAMING SAILS, ROPES, AND SPARS.

Points about "Columbia."

Length, 102.135 feet; water-line, 89.66 feet; draught, 19 feet; beam, 24 feet; height of mast, 134.75 feet; thickness of hull, 3-16 inch; built of bronze; sail area, 13,125.45 square feet; steered by a wheel; commander, Captain Barr; crew, 36 men; built at Bristol, R. I.; mast made of Oregon pine; launched June 10, 1899; designed by Captain Nat. Hereshoff. Built new boat "Constitution" in trial races, but did not sail her.

Points about "Shamrock II."

Length, 137 feet; water-line, 89 feet; draught, 19 feet 6 inches; beam, 23 feet 6 inches; height of mast, 148 feet; weight of mast, 4 tons; boom, 112 feet; thickness of hull, 3-16 inch; built of manganese bronze; sail area, 13,400 square feet; steered by a wheel; commander, Captain Sycamore; crew, 50 men; mast and spars of steel; built at Dumbarton, Scotland; launched April 20, 1901; designed by G. L. Watson.

It is evident that "Columbia" must be very well designed, since she should beat the "Constitution," which was specially built to compete with "Shamrock II." Her sail area is over 13,000 square feet, and is slightly less than "Shamrock's." She carries about ninety tons of lead in her keel. Previous to 1899 the "Defender," the "Vigilant," and the "Volunteer" defended the cup.

"Shamrock II." has several points about her which distinguish her from previous contestants. Her mast is stepped considerably forward of the usual position. Her bronze hull requires frequent grooming to keep it glistening. She crossed the Atlantic in sixteen days. She was commanded by Captain Sycamore, and was conceded to be a very formidable antagonist.

The Owners of the Yachts.

Sir Thomas Lipton is sole owner of "Shamrock II.," but "Columbia" is owned by a syndicate of three: J. Pierpont Morgan, the well-known financier; C. Oliver Iselin, whose family have spent over 1,000,000 dollars in connection with the yacht races; and W. K. Vanderbilt. Mr. Pierpont Morgan finds his chief recreation in yachting, and has done more than merely put his money into "Columbia." There is, however, no doubt that keeping the cup costs as much as attempting to win it. Mr. E. D. Morgan, ex-commodore of the New York Yachting Club, managed "Columbia" during the 1901 races. Captain Barr with thirty men sailed the "Columbia" during the contest, Captain Sycamore sailing the "Shamrock" with about fifty men.

Almost the first practical application of wireless telegraphy was reporting the yacht race between the "Columbia" and "Shamrock II." From the vessel that followed the yachts Marconi sent messages ashore every few minutes containing full accounts of the progress of the race These despatches were posted as bulletins in New York and elsewhere, and informed the waiting public of the positions of the competing vessels at every point. Thus was the great fact illustrated that messages can be exchanged at long distances across the water.

Victorious Race of the Yacht "America" in the Great International Regatta.

GRATIFYING, in the highest degree, to the pride of every American, was the announcement that, in the great and exciting international yacht race, which formed, in an important sense, the grand finale of the "Exhibition of the Industry of All Nations," held in London, in 1851—the victory had been won by the clipper yacht "America," of one hundred and seventy tons, built by Mr. George Steers, of Brooklyn, New York, and commanded by Commodore John C. Stephens, also of New York. The prize was no less than "The Cup of all Nations."

Making but an indifferent show of contributions to the various departments of art, science, and manufactures, at that renowned exposition, the conclusion had become universal, that the United States would gain but little renown in that magnificent congress of the industries of civilization. One trial of championship, however, was yet to be made and determined—the supremacy, in respect to architectural model, equipment, nautical skill, and power of speed, upon that element the dominion of which has ever been the coveted achievement of every maritime country, and of England in particular—the high class claims put forth by the latter being well understood.

How happily it was reserved for the United States to take this honor to herself, in a manner, too, undreamed of by any compeer or rival, will appear from the following history of the great fact as given, at the time, by the press of both England and America. Indeed, in respect to the English journals and the English public, it can truly be said, that fair play and manly acknowledgment of a fair beat were never more honorably exhibited. And this last named fact is all the more creditable, considering the circumstances.

A large portion of the British peerage and gentry left their residences and forsook their usual diversions, to witness the struggle between the yachtsmen of England, hitherto unmatched and unchallenged, and the Americans who had

CUP OF ALL NATIONS, WON BY THE "AMERICA."

crossed the Atlantic to meet them. All the feelings of that vast population swarming in British ports and firmly believing in "Rule Britannia," as an article of national faith; all the prejudices of the nobility and wealthy aristocracy, who regarded the beautiful vessels in which they cruised about the channel and visited the shores of the Mediterranean every summer as the perfection of naval architecture, were roused to the highest degree; and even the Queen of England did not deem the occasion unworthy of her presence.

Until the very day, August twenty-second, 1851, of this celebrated contest, no Englishman ever dreamed that any nation could produce a yacht with the least pretensions to match the efforts of White, Camper, Ratsey, and other eminent builders; and in the pages of the Yacht List for that very year (1851), there was an assertion which every man within sight of sea water from the Clyde to the Solent would swear to, namely, that "yacht building was an art in which England was unrivaled, and that she was distinguished pre-eminently and alone for the perfection of science in handling them."

Of the seventeen yacht clubs in various parts of the united kingdom, not one of them had ever seen a foreigner enter the lists in the annual matches. It was just known that there was an imperial yacht club in St. Petersburg, maintained, it was affirmed, by the imperial treasury, to encourage a nautical spirit among the nobility, and that a few owners of yachts at Rotterdam had enrolled themselves as a club; but, till the "America" came over, the few who were aware of the fact that there was a flourishing club in New York did not regard it as of the slightest consequence, or as at all likely to interfere with their monopoly of the glory of the manliest of all sports.

The few trial runs made by the "America," on her arrival in English waters, proved her to be of great speed, and satisfied the English critics that her owners were not so little justified as at

first they had been thought, in offering to back an untried vessel against any other yacht for the large sum of fifty thousand dollars, or for a cup or piece of plate. An interesting reminiscence or two, in this connection, related by Colonel Hamilton, a member of the club, may here be given, namely:

New Nautical Wonder.

There had previously been some talk among the members of the New York yacht club, of a race with the yachts of England, and Mr. W. H. Brown, the well-known and skilful ship-builder, had undertaken to build a schooner that should outsail any other vessel at home or abroad, and he agreed to make the purchase of her contingent upon her success. His offer was accepted by the yacht club. And now, to the master hand and brains of that accomplished architect, George Steers, was confided the task of furnishing the model of this—to be—nautical wonder.

The "America" was built. Failing, however, in repeated trials, to beat Commodore Stevens' yacht, "Maria," the club were not bound to purchase. But the liberality of the original offer was so great, in assuming all risk, and the vessel in fact proved herself so fast, that several gentlemen, the commodore at the head, determined to buy her and send her out. She was accordingly purchased, and sent to Havre, there to await the arrival of the members of the club, who were to sail her, they following in a steamer.

Everything being made ready and completed at Havre, they sailed thence to Cowes, a seaport of the Isle of Wight, the scene of the contemplated regatta. Their arrival was greeted with every hospitality and courtesy, not only by the noblemen and gentlemen of the royal yacht club, but by the officers of government. Lord Palmerston issued an order that the "America" should be admitted in all the English ports on the footing of English yachts; the custom houses were all made free to her; and the admiral of the station at Portsmouth offered every assistance and civility. The Earl of Wilton and the veteran Marquis of Anglesea, the latter eighty years of age, were among the first visitors on board.

When the time for the regatta came which was to take place on the most dangerous course possible for a stranger—in the waters of the Isle of Wight, with their currents and eddies, familiar only to those accustomed to the water—great solicitude was naturally felt by the Americans as to the pilot to be employed. Warnings of all sorts from various quarters reached them, and not to rely too much on any pilot that might offer; and the commodore was naturally perplexed.

An English Pilot.

But here again the English admiral, with an intuitive perception of the difficulty, of which no mention, nevertheless, had ever been made to him, told Commodore Stevens that he would furnish him with a pilot for whom he himself would be answerable. The offer was as frankly accepted as it was honorably made. The pilot came on board, and never for a moment was there a suspicion on any mind that he was not thoroughly honest and reliable.

Yet so strong was the distrust among Americans outside that even after the

pilot was in charge, the commodore was warned by letter not to trust too much to him, and urged to take another pilot to overlook him. But the commodore's own loyalty of character would not entertain such a proposition; he gave his confidence to the pilot sent him, and it was completely justified.

Picturesque Scene.

The "London Times" said that never in the history of man, did Cowes present such an appearance as on the eventful day appointed for this race. Upwards of one hundred yachts lay at anchor in the roads, the beach was crowded, and the esplanade in front of the club swarmed with ladies and gentlemen, and with the people inland, who came over in shoals, with wives, sons and daughters, for the day. Booths were erected all along the quay, and the roadstead was alive with boats, while from sea and shore arose an incessant buzz of voices mingled with the splashing of oars, the flapping of sails and the hissing of steam from the excursion vessels preparing to accompany the race.

Flags floated from the beautiful villas which stud the wooded coast, and ensign and barges, rich with the colors of the various clubs or the devices of the yachts, flickered gayly out in the soft morning air. The windows of the houses which commanded the harbor were filled from the parlor to the attic, and the "old salts" on the beach gazed moodily on the low black hull of "the Yankee," and spoke doubtfully of the chances of her competitors.

Some thought the "Volante" might prove a teaser if the wind was light; others speculated on the "Alarm" doing mischief if there was wind enough to bring out the qualities of that large cutter in beating up to windward and in tacking; while more were of the opinion that the "America" would carry off the cup, "blow high, blow low." It was with the greatest difficulty the little town gave space enough to the multitudes that came from all quarters to witness an event so novel and interesting.

Among the visitors were countless strangers—Frenchmen en route for Havre; Germans, in quiet wonderment at the excitement around them, and Americans, already triumphing in the anticipated success of their countrymen.

Off Goes the Gun.

Eighteen yachts were entered, and were moored in a double line from Cowes castle, the "Beatrice" being nearest that point, the "America" about midway and the "Aurora" farthermost. The mist which hung over the fields and woods from sunrise was carried off about nine o'clock by a very gentle breeze from the westward, which veered round a little to south soon afterwards, and the morning became intensely warm.

At five minutes before ten o'clock the preparatory gun was fired from the club-house battery, and the yachts were soon sheeted from deck to topmast with clouds of canvas, huge gaff topsails and balloon jibs being greatly in vogue, and the "America" evincing a disposition to take advantage of her new jib by hoisting it with all alacrity. The whole flotilla not in the race were already in motion, many of them stretching down towards Osborne and Ryde, to get a good start of the clip-

pers. Of the yachts that entered, fifteen started, seven of these being schooners and eight cutters.

Precisely at ten o'clock, the signal gun for sailing was fired, and before the smoke had well cleared away the whole of the beautiful fleet was under way, moving steadily to the east with the tide and a gentle breeze. The start was effected splendidly, the yachts breaking away like a field of race horses; the only laggard was the "America," which did not move for a second or so after the others. Steamers, shore boats and yachts of all sizes buzzed along on each side of the course, and spread away for miles over the rippling sea—a sight such as the Adriatic never beheld in all the pride of Venice—such, indeed, as was never before known in the annals of yachting.

Distinguished Spectators.

Soon after they started a steamer went off from the roads with the members of the sailing committee—Sir B. Graham, Bart., commodore of the royal yacht squadron, and other distinguished gentlemen. The American minister, Hon. Abbott Lawrence, and his son, Colonel Lawrence, attache to the American legation, arrived too late for the sailing of the "America," but were accommodated on board the steamer, and went round the island in her.

The "Gypsy Queen," with all her canvass set, and in the strength of the tide, took the lead after starting, with the "Beatrice" next, and then, with little difference in order, the "Volante," "Constance," "Arrow," and a flock of others. The "America" went easily for some time under mainsail, with a small gaff-topsail of a triangular shape braced up to the truck of the short and slender stick which served as her main-topmast, foresail, fore-staysail and jib, while her competitors had every cloth set that the club regulations allowed.

Began to Creep Up.

She soon began to creep upon them, passing some of the cutters to windward. In a quarter of an hour she had left them all behind except the "Constance," "Beatrice" and "Gypsy Queen," which were well together and went along smartly with the light breeze. Once or twice the wind freshened a little, and at once the "America" gathered way and passed ahead of the "Constance" and "Beatrice." Another puff came and she made a dart to pass the "Gypsy Queen," but the wind left her sails, and the little "Volante" came skimming past her with a stupendous jib, swallowing up all the wind that was blowing.

The glorious pageant passing under Osborne House formed a pageant surpassingly fine, the whole expanse of sea from shore to shore being filled, as it were, with a countless fleet, while the dark hull of the "Vengeance," eighty-four, in the distance at Spithead towered in fine relief above the tiny litte craft that danced around her; the green hills of Hampshire, the white batteries of Portsmouth, and the picturesque coast of Wight forming a fine framework for the picture.

As the "Volante" passed the "America," great was the delight of the patriotic, but the nautical knowing ones shook their heads, and said the triumph would be short-lived; the breeze was freshening,

and then the sprightly cutter must give way, though she was leading the whole squadron at the time.

At half-past ten, the "Gipsy Queen" caught a draught of wind and ran past the "Volante"—the "Constance," "America," "Arrow," and "Alarm," being nearly in a line; but in fifteen minutes, the breeze freshened again for a short time and the "America" passed the "Arrow," "Constance," and "Alarm," but could not shake off the "Volante" nor come up to the "Gipsy Queen," and exclamations were heard of "Well, Brother Jonathan is not going to have it all his own way," etc.

Great Excitement on Shore.

Passing Ryde, the excitement on shore was very great, and the vast pier was densely crowded. But the "America" was forging ahead, and lessening the number of her rivals every moment. The Sandheads were rounded by the "Volante," "Gipsy Queen," and "America," without any perceptible change in point of time, at eleven o'clock, the last being apparently to leeward. Again, the wind freshened, and the fast yachts came rushing up before it, the run from the Sandheads being most exciting, and well contested. Here one of the West India mail steamers was observed paddling her best, to come in for some of the fun, and a slight roll of the sea inwards began to impart a livelier motion to the yachts, and to render excursionists, whether male or female, ghastly-looking and uncomfortable.

The yachts "Volante," "Freak," "Aurora," "Gipsy Queen," "America," "Beatrice," "Alarm," "Arrow," and "Bacchante," were timed off Norman's Land buoy; the other six were staggering about in the rear, and the "Wyvern" soon afterwards hauled her wind, and went back towards Cowes.

At this point, the wind blew somewhat more steadily, and the "America" began to show a touch of her quality. Whenever the breeze took the line of her hull, all the sails set as flat as a drumhead, and, without any careening or staggering, she "walked along" past cutter and schooner, and, when off Brading, had left every vessel in the squadron behind her, with the exception of the "Volante," which she overtook at half-past eleven, when she very quietly hauled down her jib,—as much as to say she would give her rival every odds,—and laid herself out for the race round the back of the island.

"Yankee" Flew Like the Wind.

The weather showed signs of improvement, as far as yachting was concerned; a few seahorses waved their crests over the water, the high lands on shore put on their fleecy "nightcaps" of cloud, and the horizon looked delightfully threatening; and now "the Yankee" flew like the wind, leaping over, not against, the water, and increasing her distance from the "Gipsy Queen," "Volante," and "Alarm," every instant. The way her sails were set evinced superiority in the cutting which the English makers would barely allow, but, certain it was, that while the jibs and mainsails of her antagonists were "bellied out," her canvas was as flat as a sheet of paper.

No foam, but rather a water-jet rose from her bows; and the greatest point of

resistance—for resistance there must be somewhere—seemed about the beam, or just forward of her mainmast, for the seas flashed off from her sides at that point every time she met them. While the cutters were thrashing through the water, sending the spray over their bows, and the schooners were wet up to the foot of the foremast, the "America" was as dry as a bone. She had twenty-one persons on her deck, consisting of the owners, the crew, cook, and steward, a Cowes pilot, and some seamen. They nearly all sat aft, and, when the vessel did not require any handling, crouched down on the deck by the weather bulwarks.

Steamer Almost Distanced.

The "Gipsy Queen," when a little past Brading, seemed to have carried away her foresail sheets, but even had it not been so, she had lost all chance of success. The "America," as the wind increased, and it was now a six-knot breeze, at least, hauled down her wee gaff-topsail, and went away under mainsail, foresail, and fore-staysail, so that it required the utmost the steamer could do to keep alongside of her. This was her quickest bit of sailing, for on rounding the east point of the island it was necessary to beat to the westward, in order to get along the back of the Wight.

At 11.37, the "Arrow," "Bacchante," "Constance," and "Gipsy Queen," stood away to the north, to round the Nab, imagining that it was requisite to do so, as the usual course was to go outside the lightship, though the cards did not specify it on this occasion.

The "America" and most of the other yachts kept their course round the Foreland and by Bembridge. She ran past the white and black buoys at a tremendous rate, and, at 11.47, tacked to the west, and stood in towards the Culver cliffs, the nearest yacht being at least two miles to leeward or astern of her. She was not very quick in stays on this occasion, and it would seem she was not very regular in that maneuver, sometimes taking a minute,sometimes thirty seconds, to perform it.

At 11.58, she stood out again to the southeast, and, having taken a stretch of a mile or so, went about and ran in towards Sandown. The breeze died off at this point, and to keep the cutters and light craft off, the "America" hoisted her gaff-topsail and jib once more. Under Shanklin Chine the set of the tide ran heavily against her, but still there was nothing to fear, for her rivals were miles away, some almost hull down.

Breaks New Jibboom.

While running under Dunnose,at 12.58, her jib-boom broke short off; it was broken by mismanagement on the part of the men when straining on it with the windlass, and did not snap from the action of the sail. This accident threw her up in the wind, and gave the advantage of about a quarter of an hour to her opponents, while she was gathering in the wreck. But it was of little use to them. Looking away to the east, they were visible at great distances, standing in shore, or running in and out, most helplessly astern—the "Aurora," "Freak," and "Volante," in spite of light winds and small tonnage, being two or three miles behind. The wind fell off very

much for more than an hour, and it was but weary work stretching along the coast against a baffling tide, every moment making the loss of her jib of greater consequence to the "America."

Sailing Fast.

At about 3.20, the breeze freshened, and the "America," still one mile ahead, slipped along on her way, making tacks with great velocity, and standing well up to windward. Her superiority was so decided that several of the yachts wore, and went back again to Cowes in despair; and, for some time, the "America" increased her distance every second, the "Aurora," "Freak," and "Volante," keeping in a little squadron together—tack for tack—and running along close under the cliffs. This was rather unfortunate in one respect, for, in going about, the "Freak" fouled the "Volante" and carried away her jib-boom; and the boatman's pet became thereby utterly disabled, and lost the small glimpse of fortune which the light winds might have given her.

Meanwhile, minute after minute, "the Yankee" was gaining ground, and at 3.30 was flying past "St. Lawrence" towards Old Castle, while the "Bacchante" and "Eclipse," which had been working along honestly and steadily, were about two and a half miles to leeward behind her. Further away still, were visible five or six yachts, some hull down, some dipped further still, digging into the tideway as hard as they could, and lying into the wind as well as their sails might stand it.

By this time, the "America" had got the wind on her quarter, having gone round Rocken end, and thus having a tolerably fair course from the south to northwest, up to the Needles, the wind being light and the waters somewhat broken. The persons on board the steamers were greatly astonished at seeing ahead of the "America," after she had rounded Rocken-end, a fine cutter with a jib and foresail together—"two single gentlemen rolled into one," bowling away with all speed, as if racing away for her life, and it was some time before they could be persuaded she was not the "Aurora:" but she was in reality the "Wildfire," forty-two tons, which was taking a little share in the match to herself, and had passed the End at 3.40.

The "America" Far Ahead.

The "America," however, bore straight down for the cutter, which was thoroughly well-sailed, and passed her after a stern chase of more than an hour, though the "Wildfire," when first sighted, was reckoned to be some two and a half miles ahead.

At 5.40, the "Aurora," the nearest yacht, was fully seven and one-half miles astern, the "Freak" being about a mile more distant, and the rest being "nowhere." The "America" was at this time close to the Needles, upon which she was running with a light breeze all in her favor.

Two of the excursion steamers ran into Alum Bay, and anchored there to see the race round the Needles. While waiting there an intense anxiety for the first vessel that should shoot round the immense pillars of chalk and limestone which bear the name, the passengers were delighted to behold the "Victoria and Albert," with the royal standard at the main, and the

Lord Admiral's flag at the fore, steaming round from the northwest, followed by the "Fairy," and the little dock-yard tender.

Her majesty, Prince Albert, and the royal family, were visible by the aid of a glass from the deck of the steamers. The royal yacht went past the Needles, accompanied by the "Fairy," at 5.35, but quickly returned, and at 5.45 lay to, off Alum Bay. The "Fairy" was signaled to proceed round the Needles, to bring tidings of the race, and at once started on her errand.

Cheers for the Winner.

But all doubt and speculation, if any there could have been, was soon removed by the appearance of the "America" hauling her wind round the cliff, at 5.50. The breeze fell dead under the shore, and the "America" lowered out her foresail and forestaysail so as to run before it. All the steamers weighed and accompanied her, giving three cheers as she passed, a compliment which owners and crews acknowledged with uncovered heads and waving hats.

At 6.04 the "Wildfire" rounded the Needles, and bore away after the schooner, which by this time had got almost in a line with the "Victoria and Albert;" and, though it is not usual to recognize the presence of her majesty on such occasions as a racing match—no more, indeed, than a jockey would pull up his horse to salute the queen, when in the middle of his stride—the "America" instantly lowered her ensign, blue with white stars, the commodore took off his hat, and all his crew, following his order and example, remained with uncovered heads for some minutes, till they had passed the royal yacht. The steamers as she passed on, renewed their cheering.

On turning towards the Needles, at 6.30, not a sail was in sight, but the breeze was so very slight that all sailing might be said to have finished; and it was evident that the "America" had won the cup, unless some light cutter ran up with a breeze in the dusk and slipped past her.

The Cup Presented.

The steamers returned towards Cowes, and the royal yacht, having run close by the "America," under half-steam for a short distance, went towards Osborne. Off Cowes were innumerable yachts, and on every side was heard the hail, "Is the "America" first?"—The answer, "Yes." "What's second?"—The reply, "Nothing."

As there was no wind, the time consumed in getting up from Hurst Castle to the winning flag was very considerable, the "America's" arrival first not having been announced by gun fire till 8.37. The "Aurora," which slipped up very rapidly after rounding the Needles, in consequence of her light tonnage and a breath of wind, was signaled at 8.45; the "Bacchante" at 9.30; the "Eclipse" at 9.45; the "Brilliant" at 1.20 A. M., August 23rd. The rest were not timed. Thus the "America" made good all her professions, and to Commodore Stevens was presented, by the royal yacht squadron, the well-won cup.

On the evening after the race there was a splendid display of fire-works by land and water along the club-house esplanade, at which thousands of persons were present. A reunion also took place at the club-house, and the occasion was taken of the Hon. Abbott Lawrence's presence to

compliment him on the success of his countrymen; to which his excellency made a suitable reply, humorously remarking that, though he could not but be proud of his fellow citizens, he still felt it was but the children giving a lesson to the father —as if the "America" should be purchased by English friends, the Yankee would nevertheless try to build something better in New York, so as to beat even her!

The Queen on Board.

The queen having intimated her desire to inspect the "America," the latter sailed from Cowes to Osborne, where the "Victoria and Albert" also dropped down. As the queen, with Prince Albert, and suite, neared the "America," the national colors of that vessel dipped, out of respect to her majesty, and raised again when she had proceeded on board.

The queen made a close inspection of the vessel, attended by Commodore Stevens, Colonel Hamilton, and the officers of the yacht, remaining half an hour on board, and expressing great admiration of the famous schooner. Indeed, the "America's" beautiful and ingenious model, and her remarkable sailing qualities, were the astonishment of everybody who saw the craft.

The triumph of the "America" was due to her superior model and to the unique cut and fit of her sails. The first thing that met the eye, whether the vessel was afloat or in dock, was the position of the greatest transverse section—in appearance situated at about ten-seventeenths of her whole length from forward; at this section, the bottom was nearly straight for several feet out from the keel, while the two sides included an angle of about one hundred degrees.

At the forepart, her appearance contrasted strangely with the observances of modern ship-building, namely, the avoidance of hollow water-lines, hers being very concave, and her forefoot exceedingly short, or, in other words, the lower part of the stem and gripe forming a long curve, and therefore only a small rudder being needed; in consequence of this, there was, in steering, but little impediment opposed to her passage through the water; the great draught of her water aft, eleven feet four inches, with only six feet forward, added also to her facility in steering.

Had the Best Sails.

Any defect that might be expected to result from this in sailing on a wind, was quite avoided by her great depth of keel —two feet two inches amidships. The copper was placed upon her bottom with great care, and every possible projection avoided, in order to diminish the friction in passing through the water. But by far the most distinguishing feature of the "America" was the set of her sails. The bellying of the sails of yachts universally —not only when running free, but also when sailing on a wind—was, in the case of the "America," avoided to a very great extent, and from this arose much of her superiority.

The races with Sir Thomas Lipton were conducted with the greatest good feeling and without any friction between the parties. While the merits of his craft were fully recognized, the superiority of the American yacht was evident, owing to skill in construction and sailing.

AN OSTRICH HARNESSED AND DRIVEN LIKE A HORSE

OSTRICH farms are found in Texas and California and are considered a profitable investment, thanks to the imperative demands of Dame Fashion for graceful ostrich plumes. Ostrich riding has always been considered good sport, and anyone who is venturesome enough to break a spirited colt or Mexican broncho would have no hesitation in mounting a bird, although large and strong enough to carry a full-sized man.

The ostrich shown in the illustration is the only pacing ostrich in the world driven in harness, and has paced a mile in a trifle over two minutes, and cannot be distanced by the fleetest horse.

The speed of the ostrich when it first sets out is supposed to be not less than 60 miles an hour; it does not seem to be capable of keeping up this speed for a long time. It is successfully hunted by men on horseback, who take advantage of its running in a curve, instead of a straight line, so that the hunter knows how to proceed in order to meet it. The silliness of the ostrich is proverbial, and the hunter has no great difficulty in overtaking and capturing it.

A FAMOUS TROTTER—THE ONLY OSTRICH IN THE WORLD DRIVEN IN HARNESS.

FIRST WOMAN IN AMERICA TO BE PRESIDENT OF A TELEPHONE COMPANY

A Struggle Against Many Obstacles—Great Tact and Perseverance—What a Business Woman Can Do—Plan to Increase the Number of Telephone Companies.

MRS. ANNIE M'ELROY BRETT is the first woman in the United States to be president of a telephone company. This in itself is unique, but she adds to that distinction by being the president of an electrical company. Mrs. Brett's fight for her position reads like a romance. She had to deal with franchises, pleadings before Common Councils, legal fighting of experienced enemies, getting the good will of the Mayor, financing a stock company and controlling masses of laborers.

Mrs. Brett was not elected for this position. She originated the idea, fought for her rights, elected herself president, floated the securities and began the work. Pretty good work for a young widow whose chief lieutenant was her six-year old son, whose name is Reggie!

And that's another story, which will be told later on. For Reggie has no small place in his mother's wonderful work, and if you go to El Paso, Tex., for a short stay, you will hear more about Reggie Brett than any other boy in town.

Mrs. Brett is now ranked as a rich woman, yet she is just at the beginning of her work. She thinks "there's millions in it." She is most enthusiastic about the chances for any woman with the Independent Telephone Association.

Her mental attitude is that breezy Western one which cannot understand how a woman can make preserves or knit lace for a living and then bewail the fact that she can't buy a $100 gown and must sit back in the chimney corner while the gay world rolls on.

Mrs. Brett thinks that a woman's mind is just as good as a man's mind. What he can do she can do. That if he is clever she is cleverer than the average man. If he wins out on his undertaking, she has more chance of doing so than he has, because she has woman's intuition and her winning ways. She judges character better than men, and she can persuade others to do as she wants.

Naturally Mrs. Brett reckons from her own point of view. She is capable, intelligent, with an excellent grasp for busi-

ness affairs, and she does not comprehend the view of that woman who works for the small thing for a small wage. She reckons with tens of thousands of dollars.

"Maybe you had an excellent training in business," was suggested.

"Never a day of it," she answered, "except what I learned from myself. I lived as all Southern girls did until my marriage, thinking that a dance, a flirtation, driving and riding and pretty clothes was the chief aim of a young woman's life. I married an Englishman and it was he who originated the idea of fighting a great corporation and starting out with an independent telephone. Their patents covered almost anything in use then, but he got hold of another telephone that was not in use, improved upon it and built a factory for making them. Of course, he encountered the greatest opposition from the other corporation. Heretofore they had had things their own way.

"When their patent expired he took up the improvements and began the first independent telephone line. This he located in Michigan and it was a success.

"He had some hard work on his hands from that moment. He had to fight for every inch of way, but his success aroused enthusiasm in dozens of men who saw money in the telephone business. They also went into it, and to-day you see us here in Philadelphia as a tremendous national association of independence.

"This convention with its strength, and its money, and its eminent men prove to

MRS. ANNIE M'ELROY BRETT, FIRST WOMAN PRESIDENT OF A TELEPHONE COMPANY.

us just how much business, how much money, and how much chance there is of success in an independent telephone company.

"When my husband died it was the old story. I was left to face the world with not much money and a very small boy. Mr. Brett died just when things were shaping themselves to give us an easy life. The great fight was well on, the road had been blazed, but before we could reap any harvest death came to him.

"He had been ill for so long that I had taken most of the business off his shoulders, and when his strength utterly failed, he sold out to men who could go on with his plans. Then we went into the Southwest for his health, but rest came too late to save him.

An Independent Company.

"We were at El Paso, Tex., and it came into my mind that there was my chance. I knew the business as he managed it, and I made my plans to begin a plant for an independent telephone company in this town. My great obstacle was getting a franchise. For one year I worked on that. I was a women working alone with a corporation against me, but the men of the city for me. Those Southerners always have a tender feeling for women. They'll stand by them to the last.

"Every Thursday I went to Councils and sat there with them, arguing my case with those men. A representative and an attorney from the corporation came there every Thursday also, to meet my argument by argument. Slowly things came my way, and one day the corporation sent another representative to argue the case in a speech."

Mrs. Brett had to laugh before she could go on, for here is where Reggie comes in. This is a true story of how Reggie won the franchise, and if you sit around in the pleasant sun on the broad piazzas of that Texan town there will be many a whiskered judge and gray-haired business man who will tell you the story of how six-year old Reggie plead his mother's case in court. For these Texas politicians dearly love a story, and this is a story worth the telling.

"Had the representative of the corporation been clever enough," said Mrs. Brett, "Reggie would never have had a chance. But he thought to confuse the Councils by much talking. His words were technical, his phrases complicated, and he talked majestically of what the company had done for the town in sentences that smacked of the construction room. He dwelt much and often upon the term, 'party line.' He expanded on the benefits and the cheapness and the economy in stringing 'party lines' over the town. This was their method.

Looked Like Cowboys.

"Well, he was talking to a mixed company, men of direct and few words. They were a picturesque lot. Some of them looked like cowboys; two were Mexicans; all were giant men of more force than fineness.

"They wanted directness and they didn't get it. The Mayor had been a judge for years, but his brow grew more clouded as he tried to delve through the reason why 'party lines' was so excellent for the town. I, of course, was against a

'party line.' The Mayor looked over toward the railing and saw Reggie laughing in a mischievous way. Something about the boy's face evidently caught the 'judge.' He probably was tired of the man's long speech. So he said, 'Come here, Reggie, I want you.' The Mayor put him up on the table and said to him in a semi-serious way: 'Now, Reggie, I want you to explain to these gentlemen what a party line is.'

The Boy's Speech.

"Reggie wasn't in the least abashed. He was before his good friends. He said, in child's broken talk, that he didn't know much about a party line, but that there was a widow lady at his house, where he and his mother boarded, who was number four on a party line. And that there was a lady near them who was number five on the same party line. And he knew that the widow would always count the rings, and when they struck five she would go to the telephone and listen, and hear everything that was being said to the other lady, who she didn't like.

"And one day when he was watching her she said 'Reggie, I'm so glad we are on a party line, for I know everything that's being said to Miss S——; and I can keep even with her, no matter what she's up to.'

"To say the house came down mildly expresses it. The Mayor simply roared. The Council got up and cheered, the spectators just wouldn't come to order, and as for the representative of the other corporation, his face was as red from mortification as the others were from laughing, and the uproar was increased when the Mayor said in a weak voice from laughing: 'That will do, Reggie, I now know what a party line is.'

"I got the franchise, and Reggie got the glory."

"Did Reggie's good work end there?" was asked.

"No, I wish it had. One day I came home very much disgusted with everything and the boy said, 'Mamma, do you pay solicitors for getting contracts?'

"I wearily answered 'Yes,' too tired to discuss anything.

"'Well, you don't have to pay me,' said Reggie, 'and look what I've gotten you.'

"The boy handed me a piece of paper with about two dozen names written on it of the most prominent men in town, making a contract for a year's service with my telephone as soon as the wires were strung.

Signed the Paper.

'I gazed at the paper, doubting my eyes. 'You see,' said Reggie, 'I get so tired doing nothing here while you are out working. So, I put on my best suit and went around to all of my friends at their offices and stores and I told them that my mother had to work so hard to get all these names together and that if they would just take the telephone it would help her so much, I asked them to sign their name on this paper, and told them how nice you were to me and how we did't have much money and how hard you had to work to get some and all of them ran to get the ink and put their names down.'

"And they were good, every one of them," added Mrs. Brett. "Reggie had

just scooped the town over every other solicitor. I felt very badly about it—mortified beyond measure, for I had a horrible fear that these people might think I had used the child's influence, but I hadn't the heart to scold the lad, for he had done his little best to help me.

"No, the hard work wasn't over by any means. After getting the franchise I had to raise enough money to start the plant and form a company. This I did entirely among rich Eastern men. I started out with 1500 contracts, then I based my calculations only on 800, and the opposing company only has 700.

"This practically gives me the town of El Paso, and I am already arranging for a long-distance service, as well as a local one."

"And now that you have matched yourself with men and won out, are you satisfied, or will you start in on another scheme?" was asked Mrs. Brett.

"Oh, I have a splendid seheme thought out. This is to have another telephone company, absolutely composed of women. I want every worker, every officer, members of the company and all the operators of women only."

"Will you start a school of politeness among operators?"

"I start that," Mrs. Brett laughingly answered, "in my present company. I will give a great amount of my personal attention to overhearing my operators talk to customers. One word of insolence to anyone over the line, and out they go!"

"I hear you haven't such a school in Philadelphia," she sweetly added.

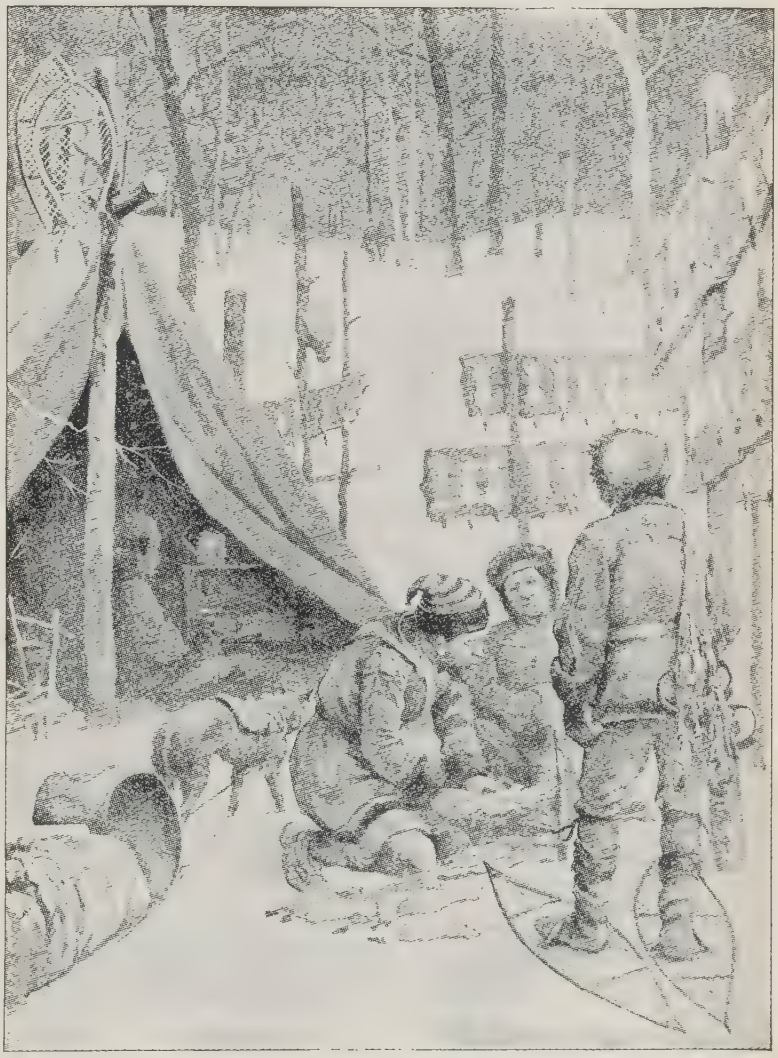
VALUABLE FURS

THERE is not only a constant demand for sealskins, but also for the skin of the ermine, and some other animals belonging to this family. The body of the ermine is long and slender, and the legs are short, as in the more familiar weasel. The length of the body is about ten inches, to which three or four inches of tail are added. The color of the stoat is ruddy brown in summer, yellowish beneath, but in winter, in the more northern parts of its distribution, the ermine changes its fur into a beautiful white. That this change occurs in direct association with the lowered temperature seems certain, though the physiology of the process is not understood. Observations seem to show that not only is the new growth of hair at the beginning of winter white, but persistent old hairs may also change.

The end of the tail always remains black and the change is sometimes only partial. The protective value of the white fur in snowy regions is obvious. Like related species, the ermine is a very lithe, restless, brave and bloodthirsty animal; it moves rapidly, and can both climb and swim well; it is terrestrial in its general habit, and finds a home among rocks and stones in walls and the like. It sucks the blood of small mammals and birds,

and while valuable in destroying rats and mice, is sometimes a troublesome poacher on the poultry-yard. It breeds at the end of the winter season.

The ermine occurs in Britain, especially in the north, is generally distributed in the northern parts of Europe, Asia and America, but is common as far south as the Pyrenees and the Italian Alps. The white fur which has long been used for trimming or lining the robes of dignitaries is not so much prized as it used to be. The skins are usually imported from Norway, Lapland, Siberia and the Hudson Bay Territories. The yellow and black tails are inserted to contrast with the white fur. Ermine is the fur of most frequent use in heraldy.



HUDSON BAY TRAPPERS PREPARING ERMINE AND MINIVER SKINS FOR KING EDWARD'S CORONATION.

Miniver is ermine fur with black spots of lambskin sewn in. Mixing the furs gives variety, and by a sharp contrast the beauty is enhanced.

There was a great demand for the two furs, ermine and miniver, for the coronation of Edward VII, and thereby the price of these commodities was raised to four or five times the ordinary figure. In view of the unusual demand the large fur companies issued orders to their stations in Hudson Bay Territory, Alaska and Siberia, for their trappers to set to work to bring in pelts as fast as possible. The accompanying illustration shows the Hudson Bay trappers preparing the furs for market. The scene is very wintry

and the hardships of the trapper's life are very great. Only the high prices paid by the fashionable world for furs could compensate these hardy men for their toil and the dangers the encounter. At the coronation of monarchs many a royal robe is decorated with furs that cost the trappers much labor and many hard struggles, yet procuring furs is a regular business in Canada.

CURIOUS MODE OF TRAVELLING

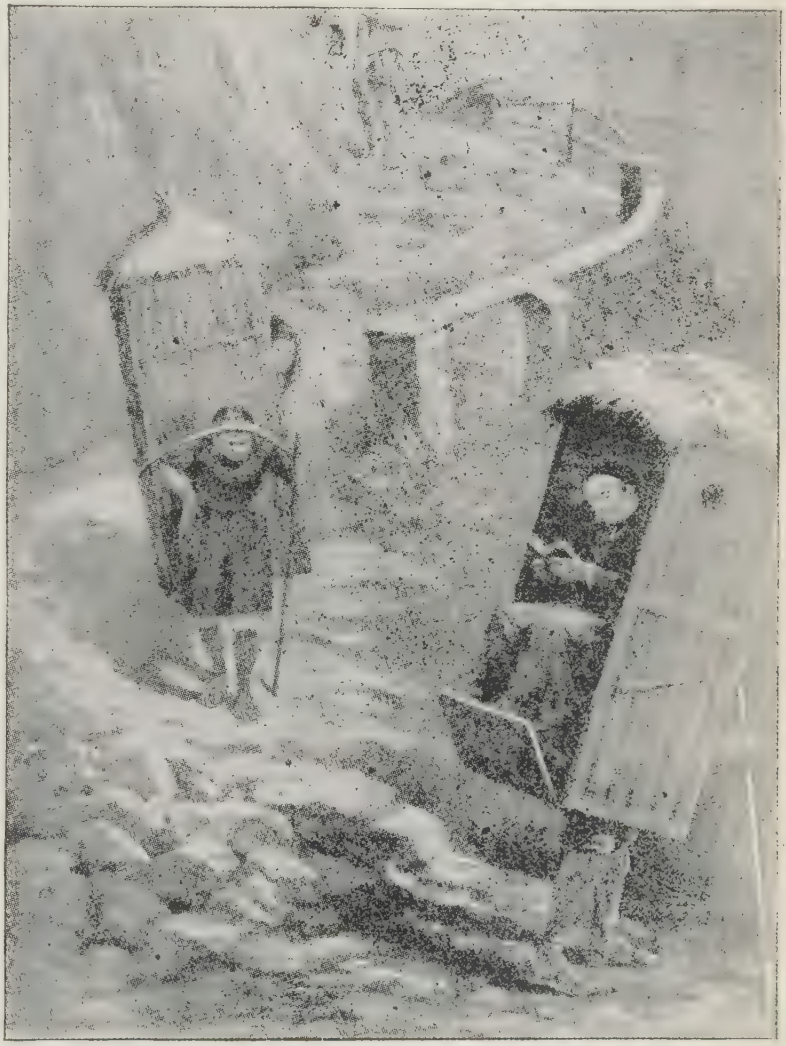
IN South America there are a number of Republics that are rich in material resources, although their territories are broken by mountain ranges and cannot be traversed in the ordinary manner. Railroads are few, and conveyances even by horse or mule are not always to be had, or do not serve the purpose. As in Switzerland, there are guides and strong men who take the travelers on their backs and carry them down the mountains and sometimes through dangerous places.

The greater part of Guatemala is mountainous, the high lands having an average elevation of about seven thousand feet above the sea, but the surface presents great variety, with extensive plains, terraces and upland valleys—the last notable for beauty, fertility and favorable climate. The main chain of mountains runs parallel with the Pacific coast, which it approaches within fifty miles. On this side, the slope is steep and broken by many volcanoes, while towards the Atlantic it sinks in a gentle incline with lower ranges extending to the water's edge.

The climate, except in low-lying districts, may be described as perpetual spring, and is generally healthy, but the people for the most part are utterly regardless of all sanitary laws. The hot coast lands on the Pacific are especially liable to visitations of yellow fever. The rainy season extends generally from April to October, April and May being the hottest months. Guatemala is a rich country. It has mines of great wealth, but which as yet are undeveloped, except partially. Gold is found in most of the river beds; some silver mines are also worked, and salt and saltpetre are taken from the earth though not in large quantities. Other minerals are lead, iron, copper, coal, quicksilver, sulphur, marble, zinc, etc. But the wealth of the country consists in its rich soil, which, according to the latitude, yields the products of every zone.

The shores are lined with mangroves, the rivers with bamboos, beyond

which rise the forests where mahogany abounds. Cocoanut and palm trees tower above the wild bananas, ferns and gingers that scantily cover the bare soil below, while there is an exuberance of orchids and trailing parasites. In the uplands are forests of hugh pines and spruces and oaks, while beneath them thick grass clothes the ground; the forests contain over a hundred kinds of timber trees, including many of the most valuable, yet owing to the absence of roads and means of transport Guatemala is obliged to import large quantities of various kinds of wood from California and other localities.



MODE OF CONVEYING TRAVELLERS OVER THE MOUNTAINS IN GUATEMALA.

Coffee is the chief export, and sugar, tobacco, cotton, india-rubber, hemp, sarsaparilla and many medicinal plants and fruits abound and are of the finest quality. The industries are chiefly confined to the manufacture of woven fabrics, pottery and saddlery. There are a few chocolate factories and flour mills. The development of the country, however, is greatly hampered by the absence of serviceable roads, which are for the most part represented by rough mule-tracks. These mule-tracks may in time become important thoroughfares, just as we often hear of old-time cow-paths in our large cities, which finally grew into city streets. Perhaps this will explain why many of the streets in some of our large towns, like Boston, for instance, are so crooked

Very singular is the method of conveying travelers in Guatemala over the mountains. Even where there are roads they may be so steep that it is difficult to traverse them. In some parts men make it their business to carry travelers in a kind of wooden box, which they fasten to their backs by a band across the forehead, as shown in the accompanying illustration. The passenger sits comfortably and looks out at the rear, while his guide with staff in hand slowly threads his way up or down the mountain paths.

This mode of conveyance is different from that employed by the Swiss porters where two are generally required for a single passenger. It is interesting to note how transportation adapts itself to the exigencies of the locality, and if the traveler cannot make his journey by railroad or stage-coach, or even on the back of a mule, he can make it by the help of native porters who become experts in their line of business.

DISASTROUS SHIPWRECKS

Dangers of the Sea—Great Loss of Life by the Sinking of Steamships—Notable Calamities.

THE history of navigation is replete with tales of terrible disasters, many of which have resulted in the loss of hundreds of lives. The news of a shipwreck that consigned passengers and crew to a watery grave always creates a deep feeling of horror, and of sympathy for the survivors who have thus suddenly been deprived of their relatives and friends. This, in some measure, is a compensation for the loss.

On the 4th of July, 1898, the French steamship "La Bourgogne," was lost off Newfoundland, with 565 lives. This was one of the most horrible calamities of recent times and no other shipwreck has created a feeling of horror so profound and universal. In this connection it is interesting to look up the record of disasters on the ocean.

In 1841, the "President" put to sea and was never heard of again. Not a spar or a boat floated to give a suggestion of her fate. She had on board 136 persons. After that came the loss of the British steamship "City of Glasgow," of the Inman Line. She left Liverpool on March 4, 1854, with 373 passengers, and officers and crew numbering 74 on board, and was never heard of after.

Her owners, Richardson Brothers, issued a letter to the public over two months after her departure, saying they thought she must have been caught in the ice off Newfoundland, and they had no fears for her ultimate safety, as she left

port in perfect condition, and could use her sails when coal gave out.

It was on Wednesday, September 27, just two weeks later, that the American steamship "Arctic," of the Collins Line, was lost off Cape Race, the southeastern extremity of Newfoundland, off which the "Bourgogne" met her fate.

The "Arctic" was run into precisely at noon by the French propeller "Vesta" (which latter put into St. John's with a few of the "Arctic's" passengers on board) and sank four and three-quarters hours afterward, causing the loss of 322 lives.

Struck in a Dense Fog.

The "Arctic" was a powerful sidewheel vessel and left Liverpool with 226 adult passengers, some children, the number of whom was not recorded, and officers and crew numbering 175 on board. She carried a heavy mail and valuable freight. The collision occurred in a dense fog while the "Arctic" was steaming thirteen knots an hour and the "Vesta" sailing east at a brisk rate. The latter vessel stove in the starboard bows of the "Arctic" and made off in the fog after picking up a few passengers. A panic on the "Arctic" followed the collision.

In the midst of it, Stewart Holland, a young engineer, displayed his cool bravery by devoting himself to firing the signal gun every few minutes, until there was no further use of doing so. When the last boat was lowered, the Duc de Grammont, a young Frenchman, leaped into it and was thrown overboard by the other occupants, who thought the boat had all it could carry, and thus perished.

The burning at sea of the Hamburg-American Line steamship "Austria," which took place on September 13, 1858, was another frightful catastrophe. The "Austria" left Hamburg for New York on September 1, touching at Southampton three days later, and took fire at 2 P. M. on the 12th, when half way between Southampton and New York.

Jumped Into the Sea.

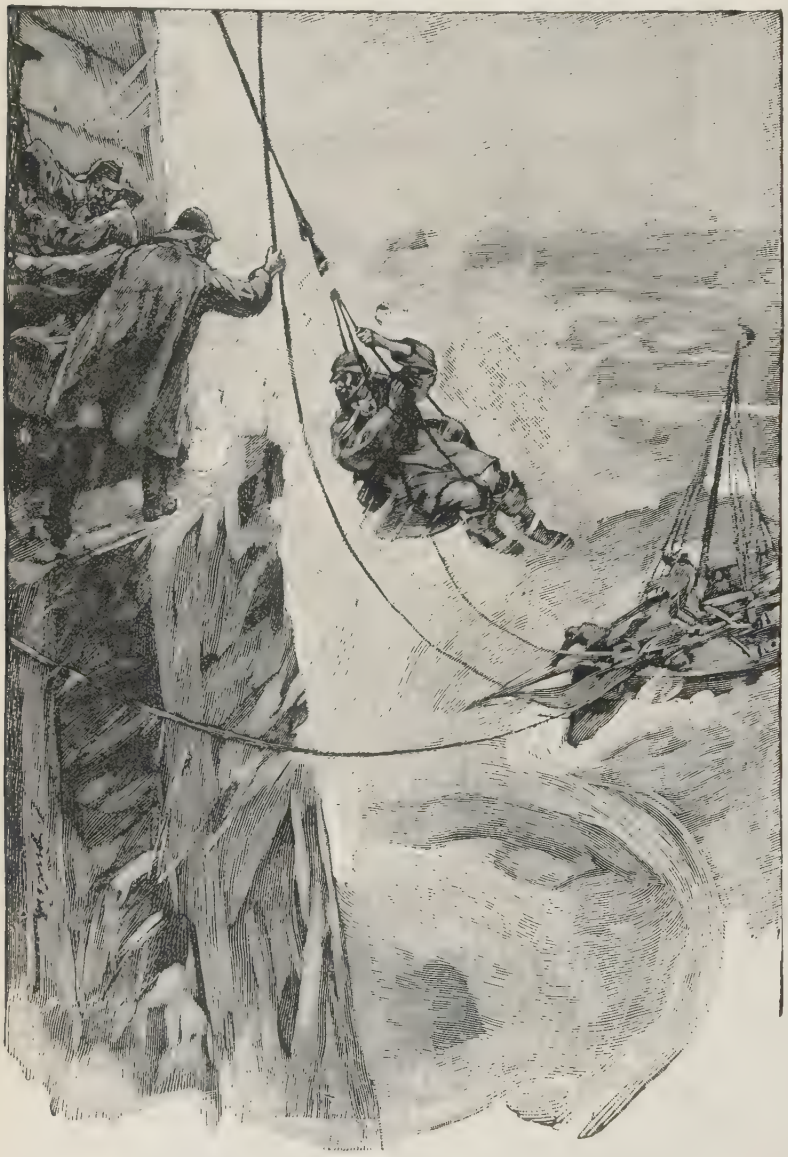
People jumped in groups into the sea to choose an easy death. One Hungarian blessed six of his children and then forced them and their mother to jump overboard, he following them with his baby in his arms. Sixty-seven people were picked up from boats the next day by the French bark "Maurice" and taken to Halifax. Those who perished numbered 470.

The next disaster in transatlantic travel comparable to the loss of the "Austria" was the loss of the British vessel "Atlantic," owned by the White Star Line, which was wrecked on April 1, 1873, near Halifax, 585 persons losing their lives.

The "Atlantic," commanded by Captain Williams, left Queenstown, at which port she touched on her way to New York from Liverpool, with 952 souls on board, not including a small number of stowaways. A heavy storm came on when she was off Halifax, and her captain decided to make that port. The vessel went ashore on Mars Head, at Cape Prospect, about 2 A. M. on April 2.

Two hours before that her captain and officers believed they were making straight for Sambro Light. An attempt was made to cut away the boats after the vessel struck, and one was soon filled with passengers. But the vessel suddenly

heeled over to leeward, falling on her beam ends, and sank almost immediately, along with the boat already referred to.



ESCAPING FROM THE WRECKED VESSEL.

To add to the horrors of the catastrophe, the hatches had been fastened down when the seamen saw the vessel had struck, and although the hatches above the men's compartment were broken, so that the male steerage passengers escaped, the women and children in the other compartment were shut off from all chances of life.

The steamer was close inshore when she struck, and one of the seamen, under direction of the third officer, managed to swim to a near-by rock with a line. By means of this line the third officer and several passengers were landed on the rock, where some of them lay down in exhaustion and froze to death. The line was finally got ashore, and with the help of some fishermen about 250 men got to land upon it.

One child, John Hendley, 12 years old, was saved, but every woman was drowned. A number of passengers reached near-by rocks and some of these, as well as some who clung to the ship's rigging, were taken off in boats which put out from shore. None of the "Atlantic's" boats could be used. The vessel was pounded to pieces on the rocks. The stowaways from the "Atlantic"

robbed many of the dead bodies washed ashore.

On November 22, 1873, the French Liner "Ville du Havre," of the Compagnie Generale Transatlantique, the line that owned "La Bourgogne," was sunk in collision at sea, and 226 people perished.

CREW AND PASSENGERS ABANDONING THE WRECK.

The "Ville du Havre" was bound for Havre from New York and was seven days out. It was 2 o'clock in the morning when she was struck by the British sailing vessel "Loch Earn," on her way from London to New York.

The "Loch Earn," which was of 1200 tons burden, was going before the wind with all sails set and as the wind was a heavy one, she was making rapid progress. Her bow caught the "Ville du Havre" amidships with a terrific crash, making a chasm twelve feet high and twenty-five to thirty feet wide, and badly damaging her own bow above the water line. She went a mile before stopping and then came about and got out four boats to pick up the struggling people.

The "Ville du Havre's" whaleboat was also out and picked up some of the unfortunates. The ship "Trimountain," from New York, which was sighted six hours after the steamer sank, took the 87 persons who were rescued from the "Loch Earn" and took them into Cardiff. Captain Surmont, of the "Ville du Havre," five officers, fifty-four of the crew and twenty-seven passengers constituted the survivors of the wreck.

The steamship "Europe," also of the Transatlantique Line, was lost the following year by foundering in mid-ocean, while on her way from Havre to New York. She left Havre on March 27, 1874, and sprung a leak about April 1. The steamer "Greece," coming from Liverpool and Queenstown, to New York, encountered the "Europe," which had eighteen feet of water in the engine room, on April 2, and took off the 400 persons aboard.

Left to Her Fate.

The "Greece" then proceeded to New York, leaving her first officer and twenty men on the foundered vessel in the hope of saving her. The crew of twenty-one sighted the "Egypt," bound from New York to Queenstown, and asked to be towed in. The "Egypt" took the "Europe" in tow, but the water so gained in her that the first officer and men of the "Greece" went on board the "Egypt" and the "Europe" was left to her fate.

A terrible disaster on May 7, 1875, was the wreck of the German steamship "Schiller," of the Eagle Line, Captain J. G. Thomas, which sailed from New York on April 28 bound for Hamburg. On coming near the Scilly Islands on May 7, some thirty-five miles southwest of Land's End, there being a heavy fog, the vessel struck on the Retainer's Lodge, near Bishop's Rock, in a terrific sea.

The loss of the Hamburg-American Line vessel "Cimbria" by collision with the steamship "Sultan," through a cause not clearly understood, took place in the North Sea on January 19, 1883. The "Cimbria" was on her way from Hamburg to Havre, carrying 360 passengers and officers and crew numbering 110. Only 67 persons were saved and these by vessels which put out to sea from neighboring shores and picked up the "Cimbria's," boats, or took passengers from the vessel's rigging, where some of them had clung for ten hours.

The sinking of the "Oregon" by a three-masted schooner off Fire Island on March 14, 1886, shortly before daylight, awakened intense interest at the time in New York. The "Oregon," a Cunard vessel, left Liverpool for New York on March 6, and was struck by the schooner when not far from Shinnecock Light, sinking eight hours later, but not till the 896 persons aboard of her had been safely transferred to the German steamship "Fulda" and brought up to the city.

Over Five Hundred Perished.

The loss of life in the sinking of the iron bark-rigged steamer "Utopia," of the Anchor Line, off Gibraltar, whither she had arrived from New York, was tremendous. The "Utopia" was approaching the Gibraltar anchorage on March 17, 1891, early in the evening, with 880 persons on board and a heavy sea running.

The gale made her so unmanageable that she fouled the bow of the British ironclad ram "Anson," thus getting her death blow. She drifted about thereafter at the mercy of the elements, the sea making the work of rescue difficult for the boats of the British Channel Squadron at Gibraltar, which undertook it. The Italians on the "Utopia" started a panic and fought their way desperately to the boats as they approached. The drowned numbered 563.

After the loss of the "Utopia" the first great disaster on the Atlantic was the sinking of the North German-Lloyd steamship "Elbe," bound from Bremen for New York, early on Wednesday morning, January 30, 1895. The "Elbe," which carried 50 cabin and 149 steerage passengers and 155 officers and seamen, was commanded by Captain K. von Goessel, who lost his life in the disaster, was run into by the British steamer "Crathie," fifty miles off Lowestoft, coast of Suffolk, England. She was to touch at Southampton and some of her passengers were for that port.

Everyone for Himself.

A heavy sea was running as the "Elbe" steamed on her southward course, firing rockets at frequent intervals to warn other vessels to keep out of her way. The "Crathie," which was going about northwest, was reported to have come on quite heedless of the warnings and without abating speed. She struck the "Elbe" abaft the engine room and then, upon getting free, her bows being badly stove in, steamed away eastward to put back into Rotterdam. Captain Gordon said that the collision was unavoidable and that he did not stop to look out for the people of the "Elbe" because he believed his own ship to be in a sinking condition.

When the "Elbe's" passengers were summoned out into the cold air of the dark January morning to find the vessel sinking, a panic ensued. It was every one for himself when the boats were lowered, and men fought their way to them in desperation. Only one woman, Miss Anna Buecher, who was on her way to France via Southampton, was rescued. She was picked up out of the icy water by a lifeboat, which was later sighted by the fishing smack "Wild Flower," which brought the lifeboat's passengers into Lowestoft at 5.40 p. m., their garments frozen stiff and their hair coated with ice. The survivors numbered 20, so that 334 persons were lost.

Suffered Horrible Tortures.

The wreck of the French steamer "Ville de Ste. Nazaire" is still fresh in the public's mind. The ship left New York for West Indian ports in the service of the same line to which "La Bourgogne" was attached, on March 6, 1897, and was to have reached Puerto-Rico on March 11. A heavy sea caught her off Cape Hatteras on Monday, March 8, and completely overwhelmed her.

Of the 82 persons on board 24 were picked up in small boats by various vessels after suffering horrible tortures of hunger and thirst; one died in these boats and seven were unaccounted for.

The wreck of the "Veendam," of the Holland-American Line, which left Rotterdam for New York on Thursday, February 3, of this year, with over 200 people on board, and struck a submerged wreck when three days out, is another recent disaster. Everyone on board of her was rescued by the American Liner "St. Louis" and taken into New York.

Notwithstanding the numerous disasters that have occurred on the ocean, the statement is made, and it is undoubtedly true, that there are fewer casualties and less loss of life in ocean travel than in travel on land, in proportion to the greater number of persons whose lives are exposed.

LARGEST SHIP AFLOAT

The Famous Oceanic—A Monster of the Deep—Dimensions of the Giant of the Ocean.

THE steamship "Oceanic" was built at Belfast for the Atlantic line of the White Star Company. The "Oceanic" is larger than the "Great Eastern" was, being 705 feet long, which is 13½ feet longer, but her breadth of beam is less by 15 feet, while she exceeds the "Great Eastern" in depth below the raised promenade deck, having seven decks in all. With the weight of cargo and coal added to that of the ship and engines, her load displacement of water is estimated at 28,500 tons; and she is considered the most powerful steamer afloat. Her speed is very great, and she ranks among the fastest ships on the ocean.

Constructed of iron and steel, this vessel is so designed as to possess great strength, and safely to carry two thousand people besides an immense cargo. She has a cellular double bottom, and the midships portion of the hull is occupied by a quadrangular iron box girder, resting upon the bilge keels and rising to the upper deck, so that the ship's back can never be broken; the plates were fixed by the new method of hydraulic riveting.

The rudder and the twin screw propellers are of the most perfect steel, and supported by fine gun metal bearings. There are two pairs of compound, low pressure, intermediate, and high pressure steam engines, with a stroke of seventy-two inches, to work the propellers, and fifteen steam boilers.

In the work of building and fitting this huge ship much assistance was obtained by the use of a specially contrived moving triple crane or "gantry" in a steel frame 95 feet high and 92 feet wide, traveling upon rails from end to end, or across the breadth of space over the extent of the operations. The launch was most correctly and successfully performed in sight of an assembly reckoned at fifty thousand people on shore, but without any ceremony of "christening."

Large ships are always a curiosity and a wonder. The "Great Eastern" inspired Jules Verne to write the fantastical novel, "A Floating City," portraying the life on the giant of the ocean.

Owing to constructional errors, however, the "Great Eastern" was not used long for a passenger boat, and eventually was used for laying cables. It had a capacity for carrying 4000 passengers. It lasted until 1888, when it was taken apart and the remains were sold.

The advantages of a large ship are many. There is one great comfort that a large boat can afford. Sea sickness is less prevalent because a larger boat gives greater resistance to the waves. In comparison the larger ships pay far better than the smaller ones. They have a tremendous capacity for carrying goods and wares, and their record-breaking speed enables them to ask high prices for passengers, adding to the wealth of their owners.

The mode of constructing a great ship in order to insure safety is as follows: She is divided, in the first place, by ordinary transverse water-tight bulkheads before and abaft the boiler and engine room. The fore part of the ship, in front of the boiler room bulkhead, is divided below the water line in two entirely separate holds or compartments by a water-tight horizontal deck; and the after part of the ship, abaft the engine room bulkhead, is also divided in the same manner by a deck.

STEAMSHIP "OCEANIC" COMPARED WITH BUILDINGS IN BROADWAY, NEW YORK.

If, therefore, the bottom of the ship should by rocks or any other means be stove in or torn away below this deck at either end, the water would be confined entirely to the lower hold or compartment, the deck forming, as it were, an internal bottom which would keep the ship afloat and seaworthy.

In like manner, should the bottom be stove in or torn away above this deck at either end, the lower hold would still remain sound and water-tight, and is made of sufficient capacity to keep the ship afloat and as buoyant as is necessary, for safety and seaworthiness.

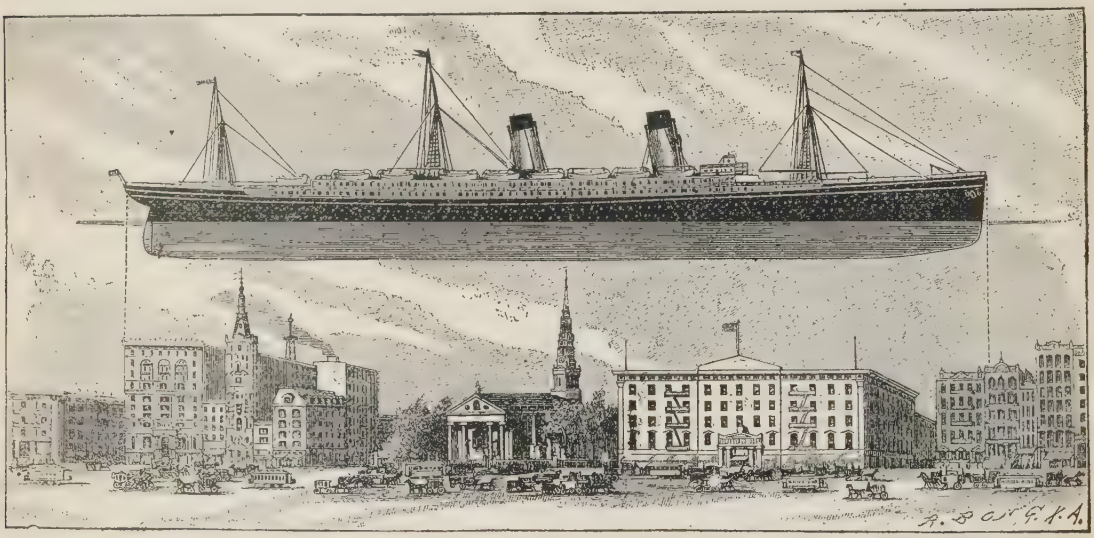
To give access to the lower hold, beneath the water-tight deck, so as to make it available at each end for carrying cargo a water-tight trunk is built up from the lower deck to the upper at each end of the ship, the deck being cut away within this trunk, so that cargo can be passed

down by a passageway which never requires to be closed up with valves or doors, like those used with ordinary water-tight bulkheads. Should water find its way into the lower holds through breaches in the bottom, it would simply rise in these trunks to the level of the sea outside, and there remain harmless.

Saving Vessels from Sinking.

The best known patented invention for saving ships from sinking has reference more particularly to ships or other vessels having two decks, the lower deck about the water line having divisions according to the size of the ship or vessel. There is a hatchway—or there may be more than one—to each division, which hatchway or hatchways is or are constructed differently to those heretofore used. The outer framing of the hatchway is made broader than hitherto, and also lower, and is rendered air tight and water tight.

Between the framing of the hatchway and the hatchway itself or the lid, the patentee places a layer of vulcanized india-rubber or equivalent material, and presses the lid on the framing by screws or similar contrivances. This lid is screwed down or otherwise secured and rendered air-tight and water-tight. The inventor employs one, two, or more pumps for forcing air, the number of pumps varying according to the size of the ship or other vessel, with requisite piping to conduct air to different parts of the ship or vessel.



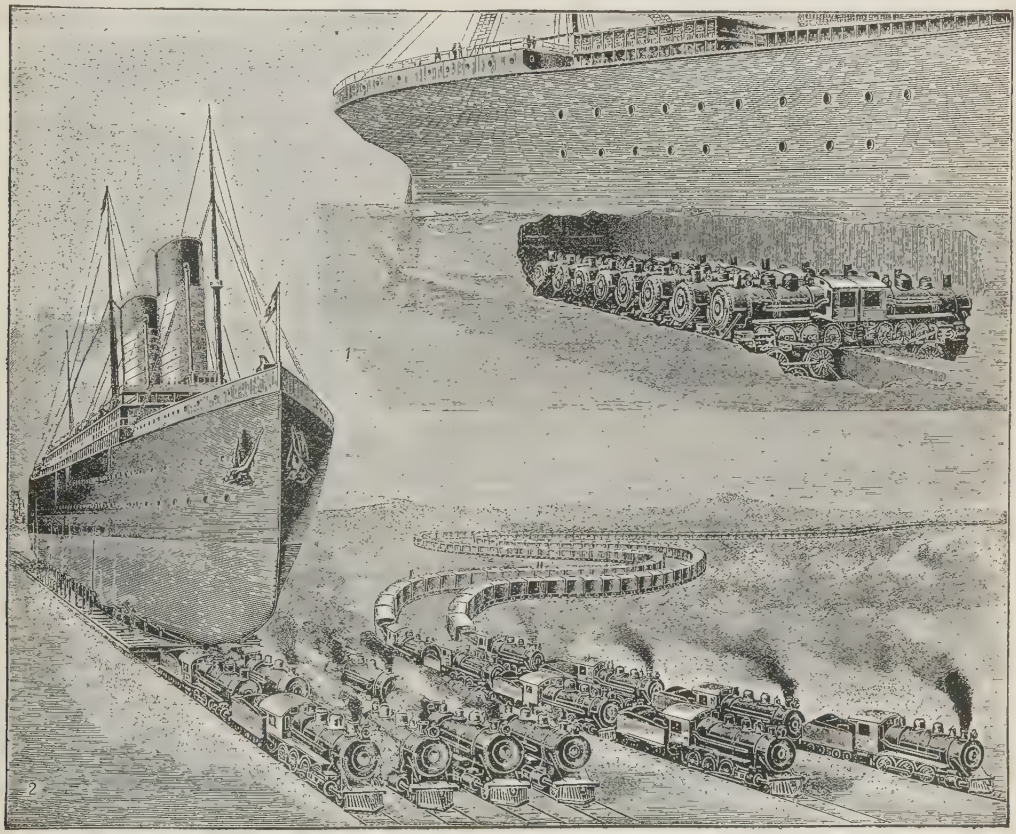
SIZE OF THE "OCEANIC" SHOWN BY COMPARISON WITH BUILDINGS.

He also employs indicators and safety valves of ordinary arrangement. He makes the windows or other outlets of the ship or vessel air-tight and water-tight, and underlays the framing thereof with vulcanized india-rubber or equivalent material, so as to render the same air-tight and water-tight. Although ships and vessels having two decks and divisions are best adapted for this invention, the invention is also applicable to ships or other vessels of other construction.

A comparison between the largest

American locomotive and the largest steamship, the "Oceanic," proves very interesting. The representation taken from the "Scientific American" shows a large locomotive built by Rogers Co. for the Illinois Central Railroad. It is calculated to draw 2000 tons and ascend a grade of 36 feet to the mile. The weight is 109 tons.

The boiler is a Velpaire type. It contains 412 pipes with a heating surface of 400 square feet. It would almost appear that the centre of gravity was at such a height to render the engine rather dangerous, especially in rounding curves. In reality, however, the centre of gravity is only 1¾ feet above the track. This gigantic engine is able to draw 3250 tons at a speed of 22 miles per hour, which amounts to 1720-horse power.



NUMBER OF LOCOMOTIVES IT WOULD TAKE TO MOVE THE LARGEST STEAMSHIP THROUGH THE WATER OR OVER A SHIP RAILWAY.

The "Oceanic" which, as already stated, exceeds the "Great Eastern," both in length and water displacement, is able, with 28,000-horse power, to attain the same speed. To attain the utmost speed, sixteen locomotives would be necessary. While the screw propeller makes 90 revolutions per minute, the locomotive wheels makes 150 revolutions. Were one to draw the "Oceanic" over a ship railway

to attain a speed of 22 miles an hour, eight locomotives would be necessary. The resistance of the water is therefore twice as great as the friction on the railway. The 28,000-horse power would be able to draw two trains of 433 cars each, weight of each car, 20 tons, each train attaining a length of three miles.

SWISS SCENERY

Mountains of Superlative Grandeur—Famous Matterhorn. Alpine Climbing—Fatal Disasters.

THE Swiss valleys are rich in rare and beautiful flowers. The whistle of the marmot may be heard in every glen. The golden eagle may be descried, poised high up in the clear blue sky, or wheeling slowly round some solitary peak; and the herd of chamois may be seen in the early morning on the heights overlooking the ordinary route of tourists. In most parts of Switzerland this wild denizen of the mountains has become very rare. From many districts it has disappeared altogether, except in almost inaccessible recesses where the hunter cannot follow, and where, of course, the passing visitor has no chance of getting a sight of it. But, says a mountain climber, I have seldom crossed any of the passes without seeing several.

On the Edge of a Precipice.

Its enemy, the eagle, never looses an opportunity to swoop down and seize a kid with his savage talons and carry it away to his mountain nest.

The adventurous mountaineer will probably attempt the passage of the Weissthor. This pass presents no very serious difficulty to expert climbers, but is a severe pull for those who are not in training; and at one or two points is trying to persons who cannot creep along the edge of a precipice without giddiness.

We rose at three, says a traveler, dressed by candle light, with a very uncomfortable feeling that we wished the work done, and Zermatt safely reached. We got away at five minutes to four, and walked up the valley for nearly an hour, calling at a cottage for rope, etc., Lochmatter, the guide, overtaking us with his ice axe.

From Night to Day.

We enjoyed the sight of the sun tipping the ridges of Monte Rosa and the other mountains as it came upon us, and the transition from darkness to dawn was very striking. We soon began to ascend by a rough path, sometimes over rocks and sometimes through water, till, in another hour, we reached a poor cottage.

From this point the ledge began in earnest, and an hour's toiling over rocks and precipitous ledges tried us very severely. We could not help resting every now and then, and our guides became a little impatient. It was no use talking, it was tremendous work. The cliff was nearly perpendicular, each step being a separate climb. The higher we

went the more fearful seemed the precipice we were scaling on looking below. After another sharp tug, the guides advised a glass of wine and a crust.

CLIMBING THE MATTERHORN, SWITZERLAND.—PERILS OF MOUNTAINEERING.

This we had, and then got on better, the guides soon telling us we had walked well the last hour. We now approached a difficulty, consisting of a steep slope of snow, like the roof of a Gothic church. The rope was now called into requisition, and we were all attached to it. Lochmatter cut some steps with his axe, and then started up. My companion then put his feet into the holes, and followed him, I next, and the other guide last. We stood still while fresh steps were cut, when the process was repeated; and in this way, after much slipping and tumbling, we gained the top of the slope, and took to the rocks again. Hence to the summit was really difficult and dangerous, being a zigzag climb up the face of the rock, with a foothold of from six to twelve inches wide and "hanging on by the eyelids."

Soon we came to a narrow space between two rocks, so smooth and perpendicular as to suggest the idea that only a chimney-sweep could get up. Lochmatter went up like a cat, and the other guide, placing me in a delightful ledge about twelve inches square, made my friend stand on his shoulders like an acrobat, and shot him up to Lochmatter, who dexterously

caught him and dragged him up. I was shot up in the same way, and the guide came scrambling after anyhow. We looked at each other in astonishment.

It was a clear space about ten feet by five feet, at the end of a ridge of rock and apparently the only point at which the ridge could be turned at all. Here, carefully arranging our legs so as not to kick each other over, we prepared to dine. It was twelve exactly, the sun was burning us, and there was not a vestige of shade. Looking the way we had come, beyond the distant peaks, we saw a lake, which our guide called Lago Maggiore.

On the other side, the way we had yet to go appeared boundless fields of snow, with a few black rocks cropping up here and there, the Matterhorn and other well-known peaks towering above them. It was a wonderful sight, but so hot that after we had eaten all we could, we soon crept amongst some rocks in the hopes of a little shelter. This we did not find; but it blew fresher on this side, and we were obliged to be content with that. After a while we prepared to descend this interminable plateau of snow; the heat of the sun had, of course, made it very soft, and we sank up to our knees at every step. We tried a glissade, but it was impossible; so we were forced to push on as best we could.

We passed close under the tremendous Cima di Jazi, whose overhanging cornice seemed as if it would fall and crush us, skirting several yawning crevasses, and we were four weary hours before we got off the snow on to the solid ice of the Gorner glacier. This was harder to the feet, but sloppy and uncomfortable. Presently we reached the first rock of the lateral moraine, and under its shelter we all lay down and slept for about three-quarters of an hour.

We passed quite around the base of Monte Rosa, and, sometimes on rocks, sometimes on the glacier, we at length struck into the path leading to the Riffel Hotel. Hence a short and easy walk brought us to Zermatt, one of the noblest centres of grand scenery in the world.

There is no place in Switzerland which has arisen so rapidly in public favor as Zermatt. Its situation is surpassingly fine, lying, as it does, in a great natural basin, into which six glaciers fall. There is a great and charming variety of scenery—savage and grand, as well as peaceful.

Perils of Ascending the Far-Famed Matterhorn.

THE Matterhorn, 14,705 feet high, differs from most of the great peaks in having two assailable sides. In the well-known view from the Riffel, its precipices are seen rising 4000 feet to a summit which, from this point, has been likened to a house—a wall and steep roof. From Breuil the whole Italian face is a pile of terraced walls. Viewed from one point, the mountain has the form of a tower; from another, of an obelisk. It has three edges or aretes.

About midway rises a tower some fifty feet high. Slopes of snow and smooth slabs lead down to the gap called Col du Lion. Beyond it rises a small peak—"a young Matterhorn"—called the Tete du Lion. In 1857 the Ame Gorret reached the Tete du Lion, but to 1860 the Matterhorn itself retained its prestige of invinci-

bility. In that year Professor Tyndall and Mr. Vaughan Hawkins, who were positively the earliest to recognize the possibility of the ascent, made their first attempt.

With the guide, J. J. Bennen, and one of the Carrels as porter, they left Breuil on the 20th of August, climbed the steep ice, and crept round the ledges of the Tete du Lion to the Col du Lion. Here they found themselves on an edge from which a stone might be dropped to the Zmutt Glacier, and on the Breuil side down a snow-crater to the green alp. They thence ascended the arete between two precipices, and through a series of dangers and difficulties, which have been well described by Mr. Hawkins in "Vacation Tourists."

After a final scramble up an ice-glazed couloir, ending below in space, they were obliged by the lateness of the hour to return. One thing they had discovered, that the rocks were not only steep and rounded, but remarkable for the little support they gave to hands and feet. In 1862 Professor Tyndall and Bennen succeeded in reaching the point of the shoulder, now called Pic Tyndall, and in exploring the ridge some way farther;

SCENE ON THE MATTERHORN, SWITZERLAND—A PLUNGE TO DEATH.

but again time failed them, and the difficulties were great.

"All the orthodox horrors," says Mr. Craufurd Grove, "are to be found on this portion of the arete." "For wild savagery," says Tyndall, "it has not its equal in the Alps." A little below Pic Tyndall is a ledge, generally covered with snow, and well seen from Breuil. The ascent from this spot had been exceedingly difficult, the only points of support being the projecting crystals of felspar, and on the return the rope was here left dangling.

Alone All Night.

In the same year Mr. Whymper pitched his tent on the arete, 500 feet above the Col du Lion, and made several attempts. One night he passed alone on this dizzy perch, and he has given an interesting description of the wild view, and of the sensations he experienced in his isolated solitude. As time drew on, he remarked something singular in the distant sky. It was like a great glow worm. It was the moonlight glittering on the slope of the Monte Viso.

In 1865 an engineer of Turin, Signor Giorando, anxious to be the first on the mountain-top, for the honor of Italy, employed a number of men with tools and ropes to work at the arete, and thus facilitate his ascent. In the meantime the opposite side was left open, and on the 14th of July the redoubtable peak was thus approached and won, but at a terrible cost. Two parties had arrived at Zeamatt to make an attempt on the Matterhorn—the Rev. Charles Hudson and Mr. Hadow, with the Chamanix guide Michel Croz and Mr. Whymper and Lord Francis Douglas.

They combined their forces, and with Peter Taugwalder as second guide, and his two sons as porters, started on the 13th by way of the Hornli ridge. From the foot of the Matterhorn they passed for a little distance along the great east face, and two hanging glaciers, and then mounted direct, without encountering any obstacle, to a height of 11,000 feet, where they pitched their tent. Starting the next morning at daylight, leaving a porter behind, they again found little difficulty as far as the shoulder.

Here, however, came the shattered wall of the house, to which the top has been compared. It was necessary to cross the ridge to the northwest face, and to climb a cliff of some 300 feet, at an angle of more than 50 degrees. This wall has occasional projections, but is sprinkled with snow, in places glazed with ice, and affords none of the usual broad resting-places. Altogether the holding is very bad, and immediately below is the head of a precipice of 4000 feet.

First Man on the Summit.

Having surmounted this obstacle, they found the slope rapidly diminish, and Mr. Whymper, running forward, was the first man on the summit. Below, on the other side, some 1500 feet, he beheld the men employed by Signor Giordano, who, seeing figures on the top, appeared stricken with panic, and retreated down the mountain.

Mr. Whymper and his party remained an hour, and then started for the descent, roped in the following order: Croz, Hadow, Hudson, Douglas, Taugwalder. Mr. Whymper was left sketching, but rejoined his companions on the wall, and

was roped to Taugwalder, thus saving his life. How the accident occurred was not well seen, but it appeared that Croz, after placing the feet of Mr. Hadow, was on the point of turning to resume the descent, when Mr. Hadow slipped and knocked him over.

Both Dragged Down.

Mr. Hudson and Lord Douglas were immediately dragged down, but Taugwalder stood firm, and the rope parted. For a moment Mr. Whymper beheld his four comrades sliding on their backs, but they then disappeared over the precipice. The accident is to be attributed to the inexperience of Mr. Hadow, and to the fact that the rope was not kept tight.

After this ascent Signor Giordano exhorted his guides to renewed efforts, and on the 17th of July they succeeded in gaining the top from the Italian side. The party consisted of the guides J. A. Carrel, J. B. Bich, J. A. Meinet, and the abbe Ame Gorret. Passing the night on the highest of the three platforms used by Mr. Whymper, and assisted in some measure by Prof. Tyndall's cord, they reached the foot of the final peak, and a little above it found a ledge which led towards the northwest face. This was a perilous route; and the only passage from it a gully, down which two of the guides were lowered by their companions, who remained to assist them back.

These two thus gained the northwest face, whence the way was easy to the top. In 1867 a better course was found, and this ascent is called the first entirely on the side of Valtournanche. It was discovered by the guides Joseph and Pierre Maquinaz, who were accompanied to the end of the arete by Victor Maquinaz, Cesar, and J. B. Carrel, and Felicite, the daughter of Cesar Carrel. They found a ridge which led them nearly straight to the summit.

In 1868 Prof. Tyndall was the first to effect the passage of the mountain—to cover the crest from Breuil to Zermatt, and his descent, in the heat of the day, down the snow-sprinkled wall on the north side, unknown both to him and his guides, Joseph and Pierre Maquinaz, and when retreat was impossible, is, perhaps, the boldest thing ever done in the Alps. On the wild ground below the Hornli they lost their way, and descended direct, and in the dark, through the steep woods of the Zmutt Valley, reaching Zermatt at midnight.

Dizzy Heights.

The crest of the Matterhorn is a delicate edge of snow 580 feet in length, and about six feet higher towards the east than the west. The vision plunges from it direct to the alp at Breuil. The ascent by the Italian side is, by all accounts, far finer than the other, but it will be always the more dangerous from falling stones, "any one of which," says the Chanoine Carrel, "peut faire votre affaire." It was also the more difficult, until the "useful but humiliating rope" was stretched.

The east face, says Mr. Grove, is "a great sad wilderness of rock," but somewhat relieved by the fantastic pinnacles of the arete. Travelers who would hesitate to venture to the top may now see something of the mountain by ascending from Zermatt to the Swiss cabane, situated about midway between the Furgge Glacier and the shoulder. To reach the

cabane on the Italian side is a formidable affair. It was erected on the Cravate by the Italian Alpine Club in 1867. From Zermatt to the Swiss cabane is about seven hours, and from thence to the summit seven or eight, but it has been done in six and a half, although this is a very short time.

On the Top of the Wetterhorn.

MANY of the peaks of the Alps have been ascended by travelers although at great risk of life. The precipices of the Wetterhorn on one side, and those of the Mettenberg on the other, rise in walls of rock so steep and, seemingly, so unbroken, that it is hard to conceive how even a chamois could make its way along them. The experienced cragsman, however, knows that the steepest rocks are almost always broken by ravines and gullies, and traversed by narrow ledges that give foothold to the skilful climber. The slope of the Wetterhorn is so extremely steep that from one to two hours must be allowed for the ascent.

The summit consists of a perilously sharp crest of frozen snow, topped by an overhanging cornice of ice. It is only by levelling the summit with an axe that space enough for a seat can be found on this dizzy eminence. Yet all these peaks have been ascended, "even that grimmest fiend of the Oberland, the Shreckhorn." Judgments differ as to the expediency—some even doubt the morality—of these perilous ascents. Reckless risking of life cannot be justified. But no one can withhold his admiration from the qualities demanded for success.

A traveler who ascended says of the view: As we wind our way up the steep side of the mountain, the mists are slowly and gracefully rising from the depths of the valley along the face of the outjutting crags. It seems as if the genius of nature were drawing a white soft veil around her bosom. But now as we rise still farther, the sun, pouring its fiery rays against the opposite mountain, makes it seem like a smoking fire begirt with clouds.

Reminder of Mount Sinai.

You think of Mount Sinai, all in a blaze with the glory of the steps of Deity. The very rocks are burning and the green forests also. Then there are the white glittering masses of the Breithorn and the Mittaghorn in the distance, and a cascade shooting directly out from the glacier. Upwards the mists are still curling and hanging to the mountains, as if trying to hide the overpowering grandeur.

"In such a season of calm weather,
Though inland far we be,
Our souls have sight of that immortal sea
Which brought us hither :
Can in a moment travel thither—
And see the children sport upon the shore,
And hear the mighty water rolling evermore !"

Alpine Climbers Seeking Crystals.

EVERYBODY who can goes to Switzerland, for all have read accounts of the wonderful Alps and romantic scenery. Boys and girls who live in the little cottages perched up on the steep sides of the Swiss mountains, when they get down

into the valleys or come to the level plain, exclaim, "Oh, what a beautiful country!" It is so different from anything they have ever known that, while, to most of us, it would be only a dead level, and anything but beautiful, to them it is most captivating.

There is much more to see in Switzerland than tall mountains covered with snow. These are very beautiful and sublime, and persons travel from all parts of the globe to gaze upon the sublimity of Alpine scenery. The most famous mountain is Mt. Blanc, the summit of which is 18,000 feet above the level of the sea.

This is the highest mountain in Europe, and is covered with perpetual snow. There is a village at the foot of Mt. Blanc which is a great resort for travelers, and from this point tourists often ascend the mountain. This is considered a somewhat daring achievement. There are guides whose only business is to conduct travelers to the summits of this and other Alpine mountains.

It often happens that on Mt. Blanc the mountaineer is overtaken by a blinding snow storm. This adds very much to the danger of the expedition. At all times the danger is great, for there are chasms, some of them thousands of feet in depth, and when one is crawling along the edge of such a precipice, knowing that one misstep would be sure destruction, he is likely to become somewhat nervous and to conclude that it is not worth while to thus expose his life simply for the glory of ascending to the summit of the highest mountain in Europe. It really requires an athlete to climb the Alps, and even then the greatest caution must be exercised lest one misstep should land the climber thousands of feet below.

Not only is Switzerland rich in scenery, not only are the loftiest mountains to be found there, yet there are other attractions for some travelers which are quite as much appreciated as the magnificent summits crowned with everlasting snow. Crystals in various forms are found upon the mountain sides, and are eagerly sought after by tourists.

The young geologist who wishes to make a valuable addition to his cabinet can very profitably spend a month among the lofty needles and rocky summits of the Alps. It requires hard climbing and not a little skill to get the coveted specimens, but no young person is properly fitted for life who has not learned that only by difficult labors and hard struggles are the best things to be secured.

Every boy and girl will have Alps to climb if they live long enough, and will need strength, courage and fortitude. But crystals are not to be had without strenuous effort. What comes the hardest is always the best. Nothing worth having comes without toil and sacrifice.

Exciting Adventures in the Alps.

PERILS always attend the Alpine tourist, a fact well illustrated by the story of an exploring party given by one of the number:

Our course, he says, was north-northwest, and was prodigiously steep. In less than two miles' difference of latitude we rose one mile of absolute height. But the route was so far from being an exceptionally difficult one that soon we stood

on the summit of the pass, having made an ascent of more than five thousand feet in five hours, inclusive of halts.

We commenced the ascent of the gully leading to a point in the ridge, just to the east of Mont Bans. So far the route had been nothing more than a steep grind in an angle where little could be seen, but now views opened out in several directions, and the way began to be interesting. It was more so, perhaps, to us than our companion, M. Reynaud, who had no rest in the last night. He was, moreover, heavily laden. Science was to be regarded —his pockets were stuffed with books; heights and angles were to be observed— his knapsack was filled with instruments; hunger was to be guarded against—his shoulders were ornamented with a huge nimbus of bread, and a leg of mutton swung behind from his knapsack, looking like an overgrown tail.

Moved to Laughter.

Like a good-hearted fellow, he had brought this food, thinking we might be in need of it. As it happened, we were well provided for, and, having our own packs to carry, could not relieve him of his superfluous burdens, which, naturally, he did not like to throw away. As the angles steepened the strain on his strength became more and more apparent. At last he began to groan. At first a most gentle and mellow groan, but as we rose so did his groans, till at last the cliffs were groaning in echo and we were moved to laughter.

Our sturdy guide, Croz, cut the way with unflagging energy throughout the whole of the ascent, and at length we stood on the summit of our pass, intending to refresh ourselves with a good halt; but just at that moment a mist, which had been playing about the ridge, swooped down and blotted out the whole of the view on the northern side.

Croz was the only one who caught a glimpse of the descent, and it was deemed advisable to push on immediately, while its recollection was fresh in his memory. We are, consequently, unable to tell anything about the summit of the pass, except that it lies immediately to the east of Mont Bans, and is elevated about eleven thousand three hundred feet above the level of the sea. It is the highest pass in Dauphine.

A Huge Chasm.

We commenced to descend by a slope of smooth ice, the face of which, according to measurement, had an inclination of fifty-four degrees. Croz still led, and the others followed at intervals of about fifteen feet, all being tied together, Almer, the other guide, occupying the responsible position of last man; the two guides were therefore about seventy feet apart. They were quite invisible to each other from the mist, and looked spectral even to us. But the strong man could be heard by all hewing out the steps below, while every now and then the voice of the steady man pierced the cloud: "Slip not, dear sirs; place well your feet; stir not until you are certain."

For three-quarters of an hour we progressed in this fashion. The ax of Croz all at once stopped. "What is the matter, Croz?" "Matter enough, gentlemen." "Can we get over?" "Upon my word, I don't know; I think we must jump." The clouds rolled away right

and left as he spoke. The effect was dramatic. It was preparatory to the "great sensation leap" which was about to be executed by the entire company.

Some unseen cause, some cliff or obstruction in the rocks underneath, had caused our wall of ice to split into two portions, and the huge fissure which had thus been formed extended on each hand as far as could be seen. We, on the slope above, were separated from the slope below by a mighty crevasse. No running up and down to look for an easier place to cross could be done; the chasm had to be passed then and there.

A Perilous Jump.

A downward jump of fifteen or sixteen feet, and a forward leap of seven or eight feet had to be made at the same time. That is not much, you will say. It was not much; it was not the quantity, but it was the quality of the jump which gave to it its particular flavor. You had to hit a narrow ridge of ice. If that was passed, it seemed as if you might roll down for ever and ever. If it was not attained, you dropped into the crevasse below, which, although partly choked by icicles and snow that had fallen from above, was still gaping in many places, ready to receive an erratic body.

Croz untied Walker, one of our party, in order to get rope enough, and, warning us to hold fast, sprang over the chasm. He alighted cleverly on his feet, untied himself and sent up the rope to Walker, who followed his example. It was then my turn, and I advanced to the edge of the ice. The second which followed is what is called a supreme moment. That is to say, I felt supremely ridiculous. The world seemed to revolve at a frightful pace, and my stomach to fly away. The next moment I found myself sprawling on the snow, and then, of course, vowed that it was nothing and prepared to encourage my friend Reynaud.

"His Leg of Mutton Flying in the Air."

He came to the edge and made declarations. I do not believe he was a bit more reluctant to pass the place than we others, but he was infinitely more demonstrative; in a word, he was French. He wrung his hands; "Oh, what a terrible place!" "It is nothing, Reynaud," I said, "it is nothing." "Jump!" cried the others, "jump!" But he turned round, as far as one can do such a thing in an icestep, and covered his face in his hands, ejaculating, "Upon my word, it is not possible! No, no, it is not possible!"

How he came over I do not know. We saw a toe—it seemed to belong to Moore, another of our party; we saw Reynaud, a flying body, coming down as if taking a header in water, with arms and legs all abroad, his leg of mutton flying in the air, his stock escaped from his grasp; and then we heard a thug as if a bundle of carpets had been pitched out of a window. When set upon his feet he was a sorry spectacle; his head was a great snowball, brandy was trickling out of one side of the knapsack, wine out of the other. We bemoaned its loss, but we roared with laughter.

I must pay a tribute to the ability with which Croz led us through a dense mist down the remainder of the route. As an exhibition of strength and skill it has probably never been surpassed in the Alps or elsewhere. On this almost un-

known and very steep glacier he was perfectly at home, even in the mists. Never able to see fifty feet ahead, he still went on with the utmost certainty and without having to retrace a single step, and displayed from first to last consummate knowledge of the materials with which he was dealing.

Now he cut steps down one side of a gully, went with a dash at the other side, and hauled us up after him; then cut along a ridge until a point was gained from which we could jump on to another ridge; then, doubling back, found a snow bridge, across which he crawled on hands and knees, towed us across by the legs, ridiculing our apprehensions, mimicking our awkwardness, declining all help, bidding us only to follow him. He was apparently as much at home on the icy mountain as he would be in the sunny valley below; one of those brave Alpine guides who render mountain climbing possible, and are not infrequently heroes.

The Far-Famed Mount Rigi.

WONDERFUL views can be obtained from Mount Rigi, extending to an immense distance and displaying the grandeur and beauty of Alpine scenery. A recent traveler gives us the following graphic description:

The amazing panorama is said to extend over a circumference of three hundred miles. In all this region, when the upper glory of the heavens and mountain-peaks has ceased playing, then, as the sun gets higher, forests, lakes, hills, rivers, trees and villages, at first indistinct and gray in shadow, become flooded with sunshine, and almost seem floating up towards you.

There was for us another feature of the view, constituiting by itself one of the most novel and charming sights of Swiss scenery, but which does not always accompany the panorama from the Rigi, even in a fine morning. This was the soft, smooth, white body of mist, lying on most of the lakes and in the vales, a sea of mist, floating or rather brooding, like a white dove, over the landscape.

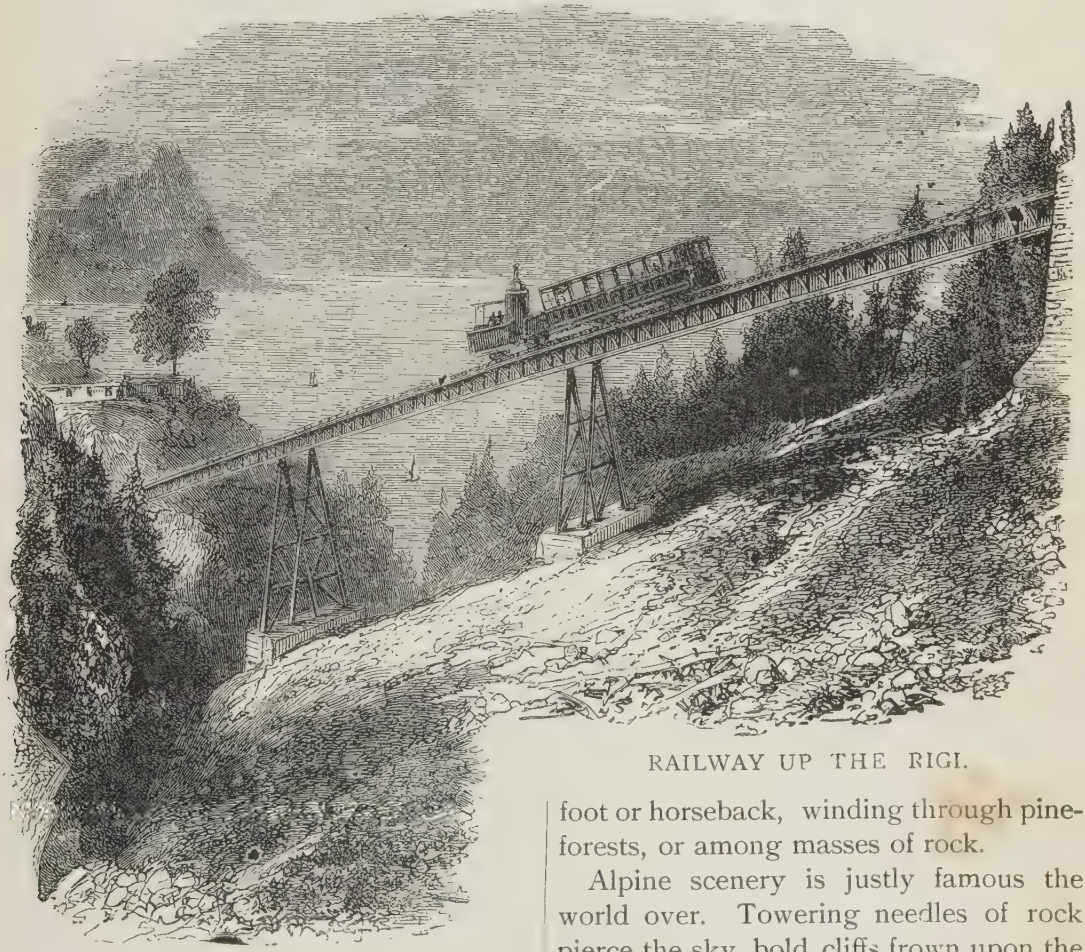
The spots of land at first visible in the midst of it were just like islands half emerging to the view. It lay over the bay of Kussnacht at our feet, like the white robe of an infant in the cradle, but the greater part of the lake of Lucerne was sleeping quietly without it, as an undressed babe.

Over the whole of the lake of Zug the mist was at first motionless, but in the breath of the morning it began slowly to move altogether towards the west, disclosing the village of Arth and the verdurous borders of the lake, and then uncovering its deep sea-green waters, which reflected the lovely sailing shadows of the clouds as a mirror.

Now the church bells began to chime under this body of mist, and voices from the invisible villages, mingled with the tinkle of sheep-bells, and the various stir of life awakening from sleep, came stilly up the mountain. And now some of the mountain-peaks themselves began suddenly to be touched with fleeces of cloud, as if smoking with incense in morning worship.

Detachments of mist begin also to rise from the lakes and valleys, moving from the main body up into the air. The vil-

lages, cottages, and white roads, dotting and threading the vast circumference of landscape, come next into view. And now on the lake Zug you may see reflected the shadows of clouds that have risen from the surface, but are themselves below us.



RAILWAY UP THE RIGI.

The ascent of the Rigi has recently been facilitated, but at the same time vulgarized, by the construction of a railway. It is, of course, only worked during the summer months, and is exposed to serious risk of damage, or even destruction in the early spring, from the melting snow, the rush of swollen torrents, and masses of falling rocks, which come thundering down with resistless force. The entire length of the railway is 17,500 feet, worked by engines of 120-horse power. Much more enjoyable, if more fatiguing, was the old mode of ascent, on foot or horseback, winding through pine-forests, or among masses of rock.

Alpine scenery is justly famous the world over. Towering needles of rock pierce the sky, bold cliffs frown upon the beholder, many mountain summits are covered with perpetual snow, and look where you will, you witness the most impressive sublimities of nature. The light on mountain summits after sunset is suggestive of the burnished glow on the walls of the Celestial City.

Meteorological Observatory on an Alpine Peak.

ON the highest peak in Germany a meteorological station has been erected. The peak, "The Zugspitze," is in the Bavarian Alps, and the intention was at first to build a sort of resting place for tourists and mountain climbers.

WEATHER STATION ON A MOUNTAIN SUMMIT.

However, as this point is a very important one from a scientific view, it was decided to use it as an observatory. The German and Austrian Alpenverein, or Alp Society, as it may be called, had planned the original project—that is, a way station—but its president, Minister Burkhardt, seeing its scientific possibilities, worked indefatigably to bring it to its present use.

In 1898 the headquarters of the society were transferred to Munich. The prince-regent, Luitpold, of Bavaria, was won over to its cause, and the Bavarian Reichstag voted a 6000 mark annuity towards its maintenance. This observatory is a branch of the central observatory of Bavaria, and young scientists are stationed there during the whole year.

The meteorological tower, as it is commonly called, is built on solid rock, and the observatory tower is built square from wood. The tower has two stories; on the top floor are various instruments and arrangements for photographing, and the lower floor is used as living compartments for astronomers. The tower is

insured against dislocation by wind and storms through the use of anchors, which are attached to heavy steel ropes and are buried in crevices of rocks.

There are sixteen of these anchors, besides four steel ropes which are fastened to the tower and rocks. The cost of construction amounted to $4000, one third of this amount being due to the difficulty of transporting the building material to its position. As it is now completed, it is the highest observatory in Germany.

VARIETIES OF IVORY

Rich Product of India and of Central Africa—Merchants and Their Caravans.

THE tusk of the male elephant, a hard solid substance, of a white creamy color, and greatly esteemed for the fineness of its grain and the high polish it is capable of receiving, is called ivory. That of India becomes yellow ; but that of Ceylon is free from this imperfection. The elephant's tusk, or true ivory, is distinguished from any other tooth substance by its transverse sections showing lines of different colors running in circular arcs and forming by their decussation minute lozenge-shaped spaces.

The term ivory is commonly extended to the teeth, horns, or tusks of the walrus, narwhal, hippopotamus, etc., which, from their large size and from their density, can be used for the same purposes in the arts as those for which true ivory is employed. Independently of its artistic use for delicate carvings, ivory is extensively used by cutlers in the manufacture of handles for knives and forks ; by miniature-painters for their tablets ; by turners in making numberless useful and ornamental objects, as well as for billiard balls, etc. The so-called ivory from the hippopotamus was formerly in favor with dentists for making false teeth, on account of its pure white color and freedom from grain.

Ivory is principally obtained from the western coast of Africa and from Hindostan, Camaroo Ivory being considered the best, on account of its color and transparency ; in some of the best tusks the tranparency can be discovered on the outside. A third kind of ivory, called the Egyptian, is lower in price than the Indian, but is uneconomical in working. Great quantities of ivory are consumed in Sheffield in making handles for cutlery ; to make up 180 tons' weight, a year's consumption, there must be about 45,000 tusks, whose average weight is nine pounds each, though some weigh from sixty to one hundred pounds.

According to this, the number of elephants killed every year is 22,500 ; but, allowing that some tusks are cast and that some animals die, it may be fairly estimated that 18,000 elephants are killed every year for their ivory, which is contrary to the usual belief, that the ivory used comes from the tusks cast by living elephants.

The finest specimens of elephants'

tusks ever sent to Europe were a pair weighing 325 pounds, obtained from an animal killed near the newly-discovered Lake Ngami, in South Africa; each tusk measured eight feet six inches in length, and twenty-two inches in basal circumference. A single tusk, weighing 110 pounds,

A CARAVAN IN EAST AFRICA CARRYING IVORY.

from the same locality, was associated with them, and regarded as a prize.

To Restore Decayed Ivory.

Mr. Layard sent to England from the ruins of Nineveh some splendid ivory carvings, which, on being unpacked, were found crumbling to pieces very rapidly. This decay, Professor Owen suggested, was owing to the loss of albumen in the ivory; and upon his recommendation the articles were boiled in a solution of albumen, when the ivory became as firm and solid as when first entombed.

The Rev. W. Milne, in his popular work on China, thus explains the mystery of these concentric ivory balls—ten, twelve, or more, cut out one within the other.

It has been conjectured that the balls are originally cut into halves, and are so strongly and nicely gummed and cemented together, that it is impossible to detect the junction; and attempts have been made to dissolve the union by soaking and boiling a concentric ball in oil, of course to no purpose. The explanation, obtained by Mr. Milne from more than one native artist, is as follows:

A piece of ivory, made perfectly round

has several conical holes worked into it, so that their several apices meet at the centre of the globular mass. The workman then commences to detach the innermost sphere, by inserting into each hole a very sharp tool with a bent point. This instrument is so placed as to cut away or scrape the ivory through each hole at equi-distances from the surface, thus working until the incisions meet.

In this way is separated the innermost ball; and to smooth, carve, and ornament it, the faces are one by one brought opposite one of the largest holes. The other balls, larger as they near the surface, are each cut, wrought, and polished precisely in the same manner; the outermost ball being of course the last. The implements employed, the size of the shaft of the tool, as well as the bend of its point, depend on the depth of each successive ball from the surface.

A REMARKABLE DUEL

General Jackson the Hero of a Personal Encounter—His Antagonist Caught in His Own Trap.

THE well known writer, John F. Coyle, is the author of the following graphic account of a historic incident in the career of "Old Hickory":

General Jackson, during his eight years in the Presidential chair, was a very familiar figure on the streets of Washington. The life-size portrait, painted by Early, which hung in the Aldermanic chamber of the City Hall, presents him to memory as I remember him in my boyhood. So much has been written of General Jackson that I will relate an incident that made him the more familiar to me, and which occurred during my boyhood.

There was a boyish rivalry existing in the different schools here, and Ned Beale was our hero, while our opponents pitted against him a boy named Evans, since a distinguished citizen of Indiana. They had met for a fistic encounter under a long arch, which at that time was the southern entrance to the grounds of the White House.

While engaged in the battle, and the old arch resounding with the shouts of the friends of the combatants, a tall figure appeared which scattered the boys, and, seizing Ned Beale, asked him what he was fighting there for. Ned said he was a Jackson boy and his opponent an Adams boy. General Jackson ordered him to put on his coat, asked him who he was, said he might shout for him, but must not fight any more, and added: "I am Jackson. If you want anything from me, come to see me at the White House."

Years had elasped when Mrs. Beale went to see General Jackson to secure a midshipman's warrant for her son. After telling the President who she was and the claims she urged for a position

in the navy for her son, Ned interrupted her and said: "Mother, let me speak to General Jackson." He approached the general, reminded him of the promise he had made, and indentified himself as the boy whom he had seized in the fight. General Jackson without a word tore off the back of a letter lying near him—that was before the days of envelopes—and wrote, "Give this boy a midshipman's warrant," and handed it to Mrs. Beale, and in a few hours Ned Beale, afterward General Edward F. Beale, entered the navy.

A Boy Soldier.

It is not generally known that General Jackson, though a boy of only thirteen years of age, took part in Sumter's successful attack on the British at Hanging Rock, S. C. He was subsequently taken prisoner by a party of Tories and ordered by the commanding officer to clean his muddy cavalry boots. "Sir," said the boy, "I am a prisoner of war and claim to be honorably treated as such." The officer in a rage drew his sword and aimed a furious blow at the child's head. Jackson threw up his left hand, thereby probably saving his life, but he received a deep cut on his hand and another on his head. Both wounds were severe, and he carried the marks of them all his life.

Jackson's devotion to his mother, whom he lost at a very early age, was as undying as his devotion to his wife. To his life's end he regarded her with unparalleled veneration. During his candidacy for the presidency in 1828 the floodgate of vituperation and slander was open not only upon himself, but upon his wife, and even his mother was assailed with vindictive calumny.

On one occasion during the campaign his wife found him weeping. In response to her looks of surprise and sympathy he pointed to a paragraph reflecting on his mother and said: "Myself I can defend, you I can defend, but now they have assailed even the memory of my mother."

Revered His Mother.

He loved to quote the maxims concerning the conduct of life, especially one: "Never to injure another, nor to accept from another an injury unredressed." Often in the heat of argument when he was at the height of his renown he would quote some homely saying with the remark, "That I learned from my good old mother." In truth that humble, pious mother had imparted to her son what was of far more value than the learning of the schools. To her influence was due his chivalrous conception of the sex. The purity as well as the probity of his character was acknowledged even by his enemies, and none of their arrows could be made to stick.

In the course of the reception given to President Jackson at Cambridge, after Harvard College had made him a doctor of laws, some little girls came up to salute him. He took the hands of these little maidens, lifted them up and kissed them. It was a pleasant sight, and one of those who witnessed it, Josiah Quincy, a political opponent, was not blind to Jackson's virtues, and thus wrote of it: "This rough soldier, exposed all his life to those temptations which have conquered public men whom we still call good, could kiss the

little children with lips as pure as their own."

General Jackson's marriage has been the cause of much misrepresentation. Mrs. Robards was deserted by her husband, who returned to Kentucky, where he took measures to procure a divorce. His petition to the legislature for that purpose was granted, and it was reported he had obtained his divorce in due form. After an investigation on the part of Mrs. Robards' friends the fact of divorce was accepted beyond question. Eighteen months later (1791) Mrs. Robards and Andrew Jackson were married.

Were in a Dilemma.

Subsequently it was discovered that there had been a hitch and some delay in the action brought by Robards and that he did not get his divorce at the time he was supposed to have secured it. As a matter of fact he did not obtain it until several months after his wife's marriage to Jackson. When this unpleasant information was verified the newly married pair found themselves in a dilemma. In the eyes of the law their marriage was not legal and it was necessary that the nuptial ceremony should be performed.

This was done and everybody seemed to be satisfied. Nevertheless, as Jackson rose to eminence and excited jealousy and envy the fact that he had unwittingly married another man's wife afforded a pretext for galling innuendoes and offensive sneers. It was a taunt based upon this incident and uttered in Mrs. Jackson's hearing that cost Dickinson his life.

It was charged that the duel in which Dickinson fell was a pre-arranged mode of getting rid of General Jackson by his enemies. The plotters, looking over the field, saw that the best way to force Jackson to a place where he could be killed with safety to themselves was to vilify his wife, provoke a duel, and see to it that the hated hero of the people stood opposite to the coolest nerve, the quickest hand, and the most deadly shot in the world. They found him in Charles Dickinson. He was a marvelously handsome man, a person of exceptional metal, as well as physical powers, and reputed the best pistol shot in the world.

Dickinson slandered Mrs. Jackson. He did it more than once. Jackson had a race horse which ran a hot race on the Nashville course. Mrs. Jackson was aglow with joy over the horse's victory, and as the horses came down the stretch she exclaimed, "Oh, he is running in front of them." Dickinson stood near. He turned insolently to some friends and said: "Yes, and a good deal like his owner—ran away with another man's wife."

Slow to Act.

Jackson did not challenge Dickinson even then for almost nine months. He put all his worldly affairs in order first, for he expected to die. His hope was to take the villain who had maligned his angel into eternity with him. Jackson challenged Dickinson. Dickinson put the meeting off a week to send for a special and celebrated pistol to kill Jackson with.

They were appointed to fight on the 30th of May, 1806, at Harrison's Mills, Logan county, Ky., a long day's ride from Nashville. Dickinson was as certain of success as he was of the sunrise. He gave to the grim occasion a gala air, and on the way he took an occasional and accu-

rate aim with his pistol at first one object and then another, and these exhibitions had a purpose and a malevolent point, part and parcel of the plot. It was arranged that Jackson should be informed of these marvelous shots in the hope that it would break his nerve.

A Foul Conspiracy.

Jackson's second was General Overton. He was of a serious, indomitable nature, something like Jackson, with a slower pulse. He was convinced, with his principal, that the whole affair was a conspiracy to murder Jackson and not a simple duel between gentlemen over a point of honor. Overton and Jackson considered and discussed this meeting for months before it occurred. They resolved to take every advantage of the would-be murderer that honor and the laws of duels permitted

The men were to fight at ten paces. Dickinson had already told his friends which button, the one over Jackson's heart, he would hit. The call was to be: "Fire—one, two, three! Stop!" and they were to fire anywhere between "fire" and "stop." Pegs were driven to mark the positions of the men.

Each man stood to his peg, and the crisis was at hand. Dickinson was known to be so quick to bring up his pistol and fire that no one could equal him. It was his expectation to kill Jackson before the latter could even raise his pistol after the word "fire." Overton and his principal had argued this also. They had finally concluded that inasmuch as the lightning-like Dickinson was bound to fire first, it was wiser for Jackson to stand and receive it, and if he survived—and it was believed he would for a minute or two at least—he could take his deliberate time and kill Dickinson like a dog.

Overton gave the word. "Fire! one!"

Dickinson's pistol came up like a flash, and exploded with the first letter of the first word. He hit the button of Jackson's coat and broke two of Jackson's ribs with his flattened bullet. Jackson stood as erect and motionless as a poplar. He had not fired. With a half cry Dickinson started back. Overton stopped counting on the instant. Cocking a pistol, with a frown like a cloud, Overton commanded him: "Step back to your peg, sir."

The Deadly Shot.

Dickinson did so with a shudder; he knew he was to die. He was caught in his own trap. Overton began again to count. Jackson with a face of flint and death looking from his gray eyes, covered his man as certainly and as surely as if it had been some inanimate target, rather than some shrinking human flesh and blood. Jackson's pistol caught at half-cock. Overton paused in his count, and Jackson recocked the weapon. Bang! went Jackson's pistol, and Dickinson, shot clear through, died nine hours later.

"I should have killed him had he shot me through the brain," said Jackson afterward.

Since Jackson's time a strong sentiment against dueling has taken possession of the popular mind. The unfortunate combat in which one of our brightest statesmen, Alexander Hamilton, was killed by Aaron Burr, has had much to do in creating this sentiment. It is justly considered that this is not the best way for settling disputes.

GIGANTIC BRONZE CANNON

AMONG the famous modern pieces of ordnance are the Italian 100-ton cannon, the English 80-ton cannon, and the Krupp 40-centimeter cannon, mighty weapons of war, which excite the astonishment and admiration of the laity. Let no one suppose that the manufacture of gigantic weapons of war belongs to modern times.

Already in the fifteenth century, when the development of heavy ordnance began, huge cannon were made, but because they failed in the requirements, the manufacture of them was discontinued. Most of the ancient cannon still in existence can be seen on exhibition either in the arsenals or in prominent places in cities or towns.

GREAT BRONZE CANNON, A MARVEL OF MILITARY ORDNANCE.

This is the case with the largest cannon—so far as caliber is concerned—ever cast, the bronze cannon in Moscow. It rests upon a stone foundation at one

corner of the barracks. In front of the muzzle lie four large shot. It was cast in 1586 by Andreas Tschochow under the reign of the Czar Theodore I.

The barrel is covered with inscriptions. In Russia it is known as the "king of the cannon," and rightly so, for although the Krupp cannon has a caliber of forty centimeters, the Russian cannon has a caliber of nearly a meter; one shot weighs two tons and the cannon itself forty tons. In comparison with modern cannon the barrel is remarkably short, measuring 5.3 meters. Although it serves only as an ornament, it attracts attention because of its size and decorations.

NOTABLE WAR-SHIPS

Vessels of Singular Construction—Evolution of the World's Naval Craft.

THE eccentric warship of one day is very apt to become the accepted warship of the next. Nothing, for example could, have seemed much more eccentric to the ordinary naval architect of 1863 than the little craft which in that year was launched at Glasgow for the Danish government and christened the "Rolf Krake." Yet she was merely the first of the long series of armored turret-ships, the prototype of the "Monitor," the "Monarch," the "Huascar," the "Dreadnaught," the "Aquidaban" and the "Hood."

Many, however, have been the designs which, though perhaps little more unconventional than the design of the original turret-ship, have failed, for various reasons, to blossom into successes. This remark applies especially to designs based upon the principles which were actually made use of in the construction of the twin passenger steamer "Castalia," now a hulk in the Thames.

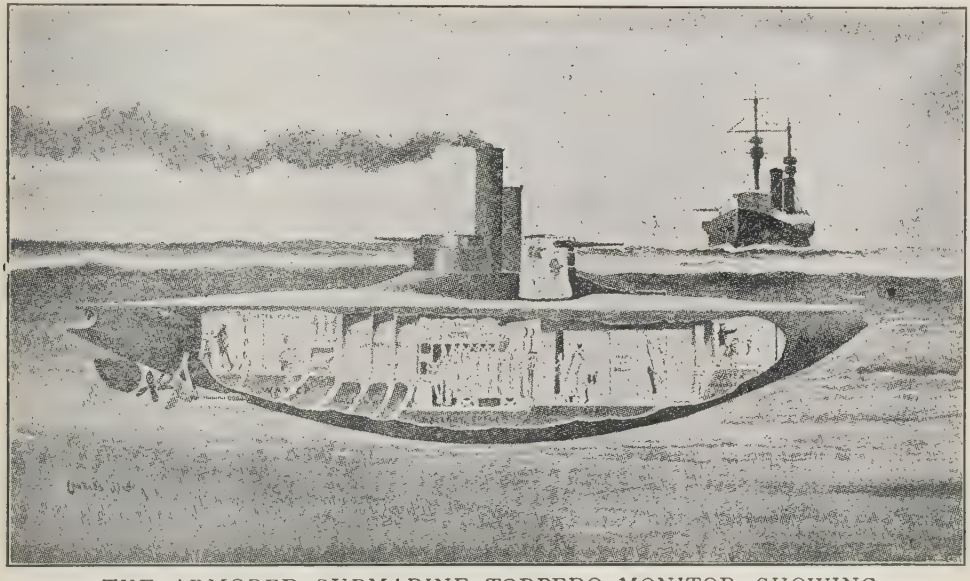
Fulton, early in the nineteenth century—for we must not go further back—designed half a dozen or more eccentric craft of various kinds and built, or partially built, two or three. His "Magnum Opus," a steam frigate, built for the American Government and bearing his name, was launched at New York in 1815, and may fairly be described not only as an eccentric vessel, but also as an extremely original one.

To quote a contemporary writer in the "Naval Chronicle" for January, 1816, "Her appearance is that of a ship split along the keel, and the two halves put asunder about fifteen feet. Under water these halves have no connection so that there is a free channel fifteen feet wide, in which the water-wheel," or paddle-wheel, "revolves. In one half is placed the boiler, twenty-two feet by eleven; in the other, the cylinder and machinery. The upper deck is thick and supported by numerous beams, but by no means

bomb-proof, yet every part of the machinery above the surface of the water is surrounded by bulwarks of wood, five feet thick, exclusive of the side of the vessel."

She had a snout or ram, thirty 32-pounder guns in broadside, two 100-pounder columbiads on pivots on the upper deck, and an extreme speed in smooth water of five knots. Concerning her, Mr. Theodore Roosevelt, the historian of the war of 1812, says, with complete justice, "The 'Fulton' was not got into position to be fought until just as the war ended. Had it continued a few months, it is more than probable that the deeds of the 'Merrimac' * * * would have been forestalled by nearly half a century. * * * For ten or fifteen years the 'Fulton' was the only war-vessel of her kind in existence, and then her name disappears from our lists." Though her armor was of wood only, she foreshadowed the ironclad.

This same Fulton was one of the pioneers of submarine navigation. As early as 1801 he built at Brest a craft of the submersible type called the "Nautilus." At her trials she remained under water for four and a half hours, moving for a time at the not very magnificent speed of one knot. By her aid Fulton blew up a small vessel. He seems to have built a second "Nautilus" in 1802. Both of these contained reserves of air for the crew, stored under pressure in copper globes.



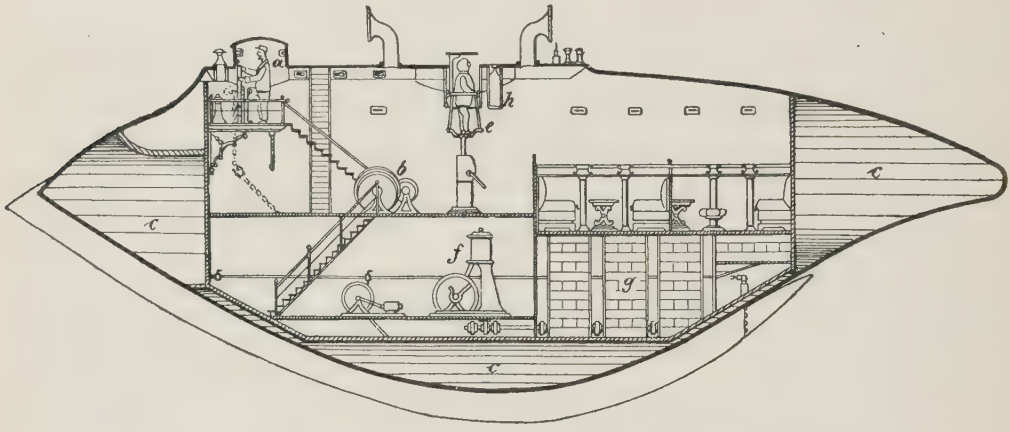
THE ARMORED SUBMARINE TORPEDO MONITOR, SHOWING ARRANGEMENT BELOW DECK.

A little later, under the assumed name of Francis, he was in treaty with Pitt, but Lord St. Vincent was, on principle, opposed to an invention, which, he feared, might go far towards neutralizing the naval power of England. At the time of his death, 1815, he was engaged in the construction of another submarine boat, to be called the "Mute," and to be armed with a submarine 100-pounder columbiad

or howitzer—the predecessor, surely, of Ericsson's submarine gun. But she must have been impracticable, for she was to be driven by no fewer than 100 men working at cranks.

Fulton had many imitators. In 1809 the brothers Coessin, at Havre, undertook experiments by order of Napoleon, in order to discover whether the "Nautilus" might not be improved upon; but they were not successful. A German, named Klinger, worked in the same direction in 1807; but the next eccentric boat-builder of importance was the famous Captain Johnson. This man, after certain proposals made by him to the British Admiralty had been refused as being "too devilish," put forward a plan for the abduction of Napoleon from St. Helena by means of a submarine boat 100 feet long. This was accepted by the Bonapartists, who promised the inventor $200,000 on the day when his boat should be ready for sea; but, unfortunately, she was not quite completed when Napoleon died. Apparently indifferent as to what master he served, Johnson subsequently exhibited a submarine boat on the Thames.

The suggestion of the marvelous craft in which Monsier Jules Verne carries his readers 20,000 leagues under the sea is undoubtedly to be found in the plans and models of Captain Mongery, of the French navy, who brought forward his inventions about 1830. His submarine ship, which measured 86 feet long by 23 feet broad, was to mount four columbiads on Fulton's principle, and to carry 100 small mines, 100 rockets, and an engine for throwing combustibles. She was submersed by admission of water and driven by steam by means of a "Martenote," the invention of a Monsieur Martenot, who had suggested it as early as 1703.



TYPE OF SUBMARINE TORPEDO BOAT.

The "Martenote" was a movable prism-shaped body attached to the stern-post and working somewhat on the principle of the single oar when used for sculling over a boat's stern. To control the horizontal motion there were horizontal rudders, as in the Whitehead torpedo and Goubet boat; there were air reservoirs for sixteen hours' supply; and the cupola over the manhole, whereby the crew entered, was so constructed as to close automatically when the craft began

to sink. It was all very ingenious, but somehow it failed to work well.

Other submarine boats have been so numerous that we have no space wherein to notice more than a very few of them. At the time of the Russian war the British Government spent $35,000 in enabling Mr. Scott Russell to make experiments in that direction. Five years later a craft named the "Plongeur" nearly drowned the French Commission, which descended in her to the bottom of the Charente, and during the American Civil war the most successful of the "Davids," or submarine boats employed by the Confederates, actually drowned the crew that manned her on the occasion of the attack upon the sloop "Housatonic." The wrecked "David" was, indeed, found sticking in the hole which she had blown in the side of her opponent. The same boat, when engaged in less conclusive affairs, had previously drowned more than one crew.

Old Relics.

Several similar Confederate craft are still preserved in the Navy Yard at Brooklyn, where they look like huge eggs propped up on the shore. About 1883, the first of Monsieur Goubet's submarine boats was constructed. Late specimens of the same type are reported to have been sold to Brazil.

Next came the Nordenfelt boats; the Campbell-Ash boat, which in 1887, owing to the unexpected silting up of Tilbury Docks, where she was tried, nearly drowned, among others, Sir William White, Chief Constructor of the Navy; the American boat "Peacemaker," the Garrett boat, the Waddington boat, the Spanish boat invented by Lieutenant Peral, the Treese-Gawn boat, the Hovgard boat, the Holland boat, an improved form of which has been adopted by our American Navy; the Chapman-Brin boat, the French boat "Gymnate," the Portugese boat "Plongeur," the American Baker boat, the Italian boat "Audace," the Italian device known as "balla nautica," the Frenchboat "Gustave Zede," and her improved relative, the "Morse."

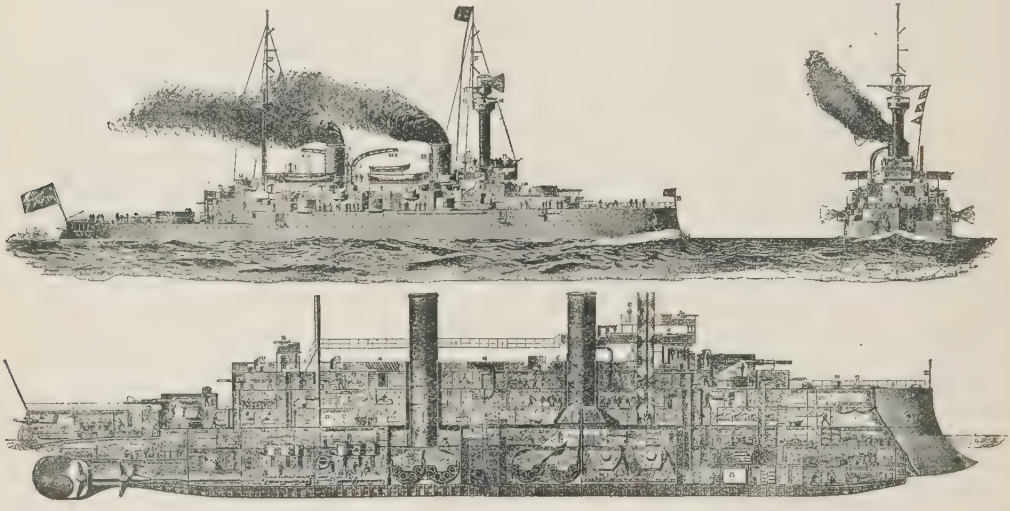
Not a Success.

Ericsson's vessel, armed, like one of Fulton's, with a submarine gun, is more celebrated, but must be counted a failure. During the late Civil war in Brazil, the "Destroyer," as she had been called by her inventor, was offered to the Government of Marshal Peixoto; but although the Brazilians bought her, they only did so in order to use her as an ordinary torpedo boat, for apparently they had no faith in the submarine gun. Nor is our dynamite gun-vessel "Vesuvius," which has three fixed pneumatic guns projecting through her upper deck at an acute angle, more highly thought of by those who have to decide on her merits; for if her guns are taken out and a good deal of money is spent on her, she may yet make a decent kind of special service craft, suitable for such work as destroying wrecks, but not much more.

The circular ironclads designed for the Russian navy by Admiral Popoff, should also be mentioned. Two of these were built, one in 1873 and one in 1875, but neither of these fulfilled the hopes of the inventor. The late Czar's yacht "Livadia" was constructed on a some-

what similar principle, but was not quite circular.

The original "cigar ship" was intended not for war purposes, but for passenger traffic at high speed. The principle was, however, adopted in a modified form in the late Sir G. R. Sartorius' designs for the torpedo ram "Polyphemus," which has been for years in commission in the Mediterranean, and which, when she was



GREAT BATTLESHIP KAISER FREDERICK III.

The lower engraving shows the interior of this famous warship.

first built, was among the fastest ships of the navy. Passing by designs for battleships with three keels, to diminish rolling, and to minimize the ill effects to the bottom in case of accidental grounding, one may regard with a little more careful attention the patented designs of Sir Edward Reed and Sir Nathaniel Barnaby, both ex-Chief Constructors of the navy, for battleships possessed of all-round fire, or something very like it, from their two or four heavy guns.

These designs were published in 1889. Sir Edward Reed's, though extremely ingenious, suffers from the fact that the two turrets, placed abreast, mask one another's fire on the beam, where the gun or guns of only one of them at a time can be trained. Sir N. Barnaby's seems to be open to the more serious objection that the plan involves the slow cooking of the gunner in his covered barbette, for he causes the funnel of his ship to pass up through the centre of the barbette, in order to avoid any obstruction of the decks outside. To work heavy guns in immediate proximity to a funnel when the ship is probably steaming her fastest is a feat which our gunners would not be in a hurry to attempt, for a funnel, no matter how well jacketed, is apt to be a very warm neighbor.

We have spoken only of eccentric warships which were, or which might have been, built and experimented with. There remains a much larger category of impracticable designs, such, for example, as the device of a Mr. Jones for enabling an

ironclad, when in danger from torpedoes, to throw or push out a sort of steel outer skin to a considerable distance from her hull.

It was found by a naval attache to whom this remarkable invention was offered, that any motion on the part of a ship while her outer skin was thus extended would infallibly result in the whole of the steel epidermis being torn off; and that, even if the ship did not move, it would be almost impossible ever to get the skin back into its place again.

There are at the Patent Office in Washington hundreds of specifications for inventions of that sort—inventions which from the first are condemned and hopeless; but the simplicity of inventors is proverbial. There is certainly no sphere in which they habitually venture so far, and come to such woeful disaster, as in the devising of new types of warships.

One of the most formidable battleships afloat is the armored cruiser "Kaiser Frederick III," built at Kiel, Germany. It is one of the most powerful war vessels in the German navy. It is constructed of steel and has a displacement of 11,000 tons. The armor is of nickeled steel, the speed 18 knots an hour. It is nearly 420 feet long and almost 68 feet in width, and is manned with 655 marines.

The accompanying engraving shows the vessel with all its compartments and the various machinery for its operation. It also shows how gigantic our modern war vessels are in comparison with the old frigates, and the end in this improvement is not yet in sight. Vessels are built to withstand destructive projectiles, and when they have arrived at that point projectiles are again invented that will destroy the improved battleships, and so it goes on alternately.

GRAND CANAL OF CHINA

Old and Celebrated Waterway, Used for Traffic Not Only in Summer, but in Winter

IN the winter, as in summer, the waterways of China are the chief articles of traffic. The boat or barge gives way to the sledge. To assist the traction the Chinaman rigs up a sail, which, with the faintest air, greatly facilitates the progress of the vehicle.

Both the Ho and the Chiang must have a course of more than 3,000 miles. These two rivers are incomparably the greatest in China, but there are many others which would elsewhere be counted great. And among those rivers we may well account the Grand Canal, intended to connect the northern and southern parts of the empire by an easy water communication; and this it did when it was in good order, extending from Peking to Hang-chau in Cheh-chaing, a distance of more than 600 miles

SAILING-SI EDGES ON THE GRAND CANAL, CHINA.

The glory of making this canal is due to Kublai, the first sovereign of the Yuan dynasty, of whom Marco Polo says: "He has caused a water communication to be made in the shape of a wide and deep channel dug between stream and stream, between lake and lake, forming as it were a great river on which large vessels can ply."

Steam communication all along the eastern seaboard from Canton to Tien-tsin has very much superseded its use and

portions of it are now in bad condition, but as a truly imperial achievement it continues to be a grand memorial to Kublai. Even Barrow wrote of it in 1806: "In point of magnitude our most extensive inland navigation in England can no more be compared to the grand trunk that intersects China than a park or garden fish pond to the great lake of Winandermere."

We have no canal in America that rivals this. Mr. Ney Ellis, the well-known writer on China, thus describes the great Chinese waterway:

Thriving Country.

The Grand Canal between the Yungtsze and the old bed of the Yellow River, is everywhere in good repair, and the adjacent country well irrigated, and apparently in a thriving state, both as regards cultivation, and, to judge by the aspect of the towns on and near its banks, as regards trade also. After crossing the old Yellow River, however, a part of the canal somewhat less known is reached, and the flourishing condition of the country is no longer noticeable; on the contrary, for a distance of about 150 miles, though the canal itself is in tolerably good working order, the country in its vicinity has an arid, sterile appearance, and is but thinly populated. There are few towns or villages, and some there are, seem neither populous nor busy, though they are not in ruins, and bear but few traces of the rebellion.

The canal, which at one time was so deep that at many places the level of the water was above that of the adjacent country, is now everywhere considerably below it, rendering irrigation, at even a short distance from its banks, without mechanical appliances, almost an impossibility; even the dry bed of the Loma Lake is scarcely cultivated on account of its elevation above the level of the canal, though it is only separated from it in some parts by a bank of a few yards in width. It is true that this lake appears never to have been more than a shallow flood lagoon, nevertheless it was some feet below the general level of the country, and was connected with the canal by means of water-courses and sluice gates; and if this is difficult to irrigate, how much more so must be the country above and beyond it.

This 150 miles being passed over, the Wai Shan Lake is reached at a small village. This is the most southern of a chain of lakes or rather lagoons, which stretch from far to the south, and constitute the only important feeder of the Grand Canal to the southward. In the summer they merge one into the other, and form a continuous sheet of water, though very shallow in parts. In winter, when the water is low, these shallow parts are mere morasses, which divide the sheet into three or four lagoons.

A Public Benefit.

In former days the canal ran in some places by the side of these lagoons, and in others through portions of them, but being everywhere embanked on both sides, it was only dependent upon them for its supply of water, the canal itself forming an unobstructed means of communication through the year. Of late years, however, this section of the canal has been allowed to go to ruin, and those portions only are used which run through the morasses existing in the dry season,

the lagoons themselves forming elsewhere the only channel for navigation.

About thirty miles beyond Nan Wang we come to the new Yellow river, the canal for that distance being extremely narrow and shallow—a mere ditch in fact, running between embankments large enough to confine a stream of infinitely greater volume. The banks along nearly the whole of the Grand Canal between the old and the new bed of the Yellow river, excepting those portions bordering on or traversing the lagoons, are surrounded by earthen walls crenellated after the fashion of city walls, behind which are stockades at intervals of a few miles.

All this work has the appearance of being recently constructed, though in many places it is already being broken up by the country people to make room for cultivation, for they can ill afford to lose that strip of land immediately adjacent to and irrigated by the canal. The villages also make an attempt at fortifications, some of them being surrounded by earthen or mud walls or moats; and, indeed, many solitary farms have some species of defensive works around them, and in most cases a small, square brick tower within. These towers are probably the "water castles" mentioned by the historian of the Dutch Embassy.

CURIOUS AMUSEMENTS

Feats Performed on Stilts by Chinese—Used by French Postmen.

THE American boy with his ball is a sight no more common in this country than that of a young Chinaman, or an old one as to that matter, flying his kite in the Flowery Kingdom. Every nation has its amusements. Not everybody cares for horse racing; not every man wants to spend time and money on a steam yacht; not all persons pay their money to see ball games, where it is shrewdly suspected that in many instances the side that is to win knows it beforehand. And as for tennis, cricket, and golf, these appeal only to a certain class of persons.

But it would seem that amusement of some kind is a natural demand. Old people are as much averse to that continuous work which makes Jack a dull boy as is Jack himself. Americans believe in recreation, but they must take it with all their might. They must wear themselves out doing nothing. College sports are an institution, and who knows but we may yet have diplomas furnished to the highest jumper as well as to the best scholar of his class. All outdoor exercises, if not carried to excess, are healthful, and an advantage to those who participate in them.

We are not so much in the habit of amusing ourselves with stilts as the Chinese are. They derive a great deal of amusement in this way, and stilt-jumping is about as attractive to them as an ordinary game of baseball is to people in our

own country. Occasionally you see a boy who has manufactured a rude pair of stilts making grotesque efforts to walk on them, and the amusing part of it is to see how utterly he fails. But the young Chinaman is more expert, and can with his stilts jump over a hedge or a pair of bars several feet in height. This, of course, requires a great deal of practice, but the ordinary Chinaman is a persevering character and somewhat persistent in what he undertakes.

STILT-JUMPING—A CHINESE PASTIME.

The pastime will never become popular in America, and this brings up again the fact that certain kinds of amusements are adapted to certain classes of persons, who enjoy them and are not enamored with any other pastime.

In China, on the birthdays of popular divinities, and on other special occasions, it is customary for men to walk through the streets on stilts and perform gymnastic feats for the amusement of the people. The performers, many of whom represent women, are gaily and fantastically attired, and usually carry emblems in their hands. The art of walking on stilts is much practised by fishermen in the towns and vilages bordering on the Gulf of Pechili, on the hard bed of the shallow waters of which the men thus upraised venture considerable distances from shore in pursuit of their prey. In some parts of France shepherds walk on stilts and postmen use them in distributing letters in country places.

Between Bordeaux and Bayonne, in France, lies that stretch of open country known as the Landes. A great part of this tract, which was formerly waste land, has been now partially reclaimed and planted with pine trees, which are cultivated for the sake of the resin that is extracted from them. The rest of it, how-

ever, remains wild and covered with gorse and broom. The villages and groups of dwelling in the Landes are very scattered, and in order to traverse the wide extent of the plains with ease, the inhabitants use stilts which are tied to their legs.

FRENCH POSTMAN MAKING HIS ROUNDS ON STILTS.

Mounted on these the shepherds watch their flocks in the brushwood, and can cross pools, marshes and peat without difficulty. They carry with them a long pole, which serves as a support when resting. The postmen, too, employ this means of getting about. In winter time, when the Landes are covered with snow, getting about on stilts is, of course, difficult, and in order to obviate the inconvenience and to enable him to get over the ground without loss of time, the postman fits to his stilts a kind of thin wooden skate, which enables him to walk on the top of the snow without sinking in.

The postman is clad in a whited cloak called a "capot," lined with sheepskin, and provided with a hood. His legs are also covered with sheepskin In the dunes the postal service is carried on by the shepherds on horseback, for it would be impossible to traverse the sandy tracts on stilts.

In our own country stilts are an amusement for boys. At some time or other every youngster must try his skill in attempting to walk in this way. The danger of a fall does not alarm the boy who considers it quite a feat to travel on these artificial legs. That stilts should ever be used for any other purpose than amusement, does not enter the mind of anyone, but, as we have seen, in other countries they are turned to a practical account. In marshy ground they are of great service sometimes to pedestrians.

LONGEST RIVERS IN THE WORLD

Streams That Help to Float the Navigation of Nations. Grand Natural Wonders.

The following is a list of the largest rivers of the world in both hemispheres:

THE MISSISSIPPI,

"The Father of Waters," is a great river of the North American continent, ranking after the Amazon as the mightiest stream on the world's surface. It drains a superficial area of one-seventh part of North America, and constitutes, with its numerous affluents and feeders, one of the grandest riparian systems known to exist.

From north to south it embraces a length of 4400 miles included, and drains along with its tributaries a basin computed to occupy 1,100,000 square miles of country. Taking its rise in Lake Itasca, Minnesota, it flows thence south-southeast as far as the point of junction of the States of Missouri, Illinois, and Kentucky, where it is joined by the Ohio —having previously received the waters of the Missouri a few miles above St. Louis. Its upper course is broken in many places by considerable cataracts, such as the Falls of St. Anthony. Its next great arm below the Ohio is the Arkansas, next the Red river, which unites with it in Lousianna.

Beside these main arteries, it receives the Wisconsin, Iowa, Des Moines, Illinois, White, St. Francis and Washita rivers, and finally emerges into the Gulf of Mexico, 120 miles below New Orleans, by a delta of several mouths, three of which, the North East Pass, the Main or South East Pass, and the South West Pass, form its principal navigable entrances. The last 300 miles of its course intersects a country so low and level, that embankments called "levees" have been constructed to protect the lands on either side from freshets and inundations.

The Mississippi is navigable for steamers to a distance of at least 2000 miles from its mouth, and thus furnishes an inland means of water communication such as no other country in the world can parallel. The navigation of this great stream is, however, impeded in many parts by contrary currents, and by obstacles in the shape of large trees, the trunks of which are imbedded far below the water's surface.

MISSOURI RIVER.

This is another great river of the North American continent, being the most important affluent of the Mississippi. It takes its rise by two forks in the east watershed of the Rocky Mountains, the most northern one of which, the Missouri

proper, flows east and north for a distance of 620 miles, receiving many feeders and passing over a fall of 170 feet in height; the other arm, the Yellowstone, joins the Missouri proper after a north-northeast course of upwards of 900 miles, after which the united stream enters the Mississippi, at a point nearly midway between Alton and St. Louis, after flowing through an extent of 3130 miles of country.

The principal affluents of the Missouri proper are the Platte, Kansas, Osage, Grand and Chariton rivers, and it is fairly navigable from the Mississippi as far up as the Falls, a distance of 2575 miles, although obstructions in the shape of sand-bars and rapids occur at various points. Its waters are muddy, with a current ranging from five to eight miles an hour.

THE COLUMBIA.

The Columbia river, the second largest stream on the western side of America, rises in the Rockies and flows westward into the Pacific Ocean. Its course is wholly within the United States, except the upper part of the west branch. It is, however, equally open to British and American trade. Its extreme length cannot be less than 1200 miles, but on account of the many portions into which it is divided by falls and rapids, is navigable only for about 90 miles.

Its navigation is of but little value, but more particularly to the British than to the Americans. In addition to the inland obstructions, its navigation is embarrassed by a surf-beaten bar; still, as a harbor, it is the best on the Pacific coast between San Francisco, 600 miles south, and Port Discovery, 150 miles north.

This great river, long vaguely supposed to exist, was discovered in 1792, by Captain Gray, of Boston, who gave it the name of his own vessel. On his return he published such flattering reports that a general desire arose to know more of the country. Accordingly, in 1804, President Jefferson sent to that territory an exploring party under Lewis and Clarke.

The history of their adventures is one of most romantic interest. Extensive trade in furs soon began. The territory was jointly occupied by English and American trappers, and disputes arose which were leading to war, but the present boundary was finally agreed upon and the question settled.

In 1836-39, American emigration set overland to this section, and, in 1846, the country was organized as a territory. Four years later Congress passed an act granting 320 acres to every man, and the same to his wife, on condition that they reside on the land for four years. Eight thousand claims were made for farms.

A remarkable feature of this section is the former path of the Columbia river, known as the "Grand Coulee." This was carved when its northern detour was obstructed by ice streams which descended from the mountains on the north and west, in the glacial period. Although now nearly dry, the course of the "Grand Coulee" may be traced over a hundred miles across the plateau. At one place it is broken by the cliffs of a former cataract that must have greatly exceeded Niagara in height and breadth. Clear, blue lakes occupy the pools excavated by the extinct cataract.

THE YUKON.

The Yukon, one of the largest rivers on the globe and the largest American

river emptying into the Pacific Ocean, rises in British Columbia and, after a course of about 2000 miles, flows through a wide delta into the Behring Sea. The river drains an area estimated at 200,000 square miles, and is said to discharge one-third more water than the Mississippi. At a distance of 600 miles from the sea, the river is a mile wide, and is navigable for over 12,000 miles.

The richest gold strike of recent years was made at Klondike on the Yukon river, in the interior of Alaska. The discovery was made by George W. McCormack who went to that region about ten years ago to engage in salmon fishing. In striking a claim for fish in August, 1896, he found gold in the gravel of a stream now known as Bonanza Creek. The news of the discovery flew over the world and people from all quarters of the United States and Canada rushed to the Yukon district, which is in Canadian territory near the American border.

The Klondike region has an area of 200,000 square miles, a territory as large as France. Dawson, the principal city of this region, is a remarkable place. It is situated only ninety miles south of the Arctic Circle, and it is said that in summer one can see to read indoors at midnight.

THE OHIO.

The Ohio (signifying "beautiful river") is formed by the union of the Allegheny and Monongahela rivers in the western part of Pennsylvania. The distance from their point of confluence to where the Ohio empties into the Mississippi, is 975 miles. The hills adjacent to the upper course of the river are mined for coal and iron, a large portion of which products are shipped by means of rafts and barges floated down the river as far as Wheeling. Between Wheeling and Louisville navigation is maintained by large steamers most of the summer, and below Louisville, all the year round.

The only rapids are at Louisville, which are passed by means of a ship-canal with locks for the largest river steamers. The area drained by the Ohio is 214,000 square miles. This is less than one-half the extent of the Missouri basin, but the volume of water discharged into the Mississippi is nearly one-third more. This fact goes to show that the amount of water a river transports is not proportionate to the area of its basin, but depends upon the amount of rainfall in the area drained, and the ratio of evaporation. Extensive forests in a river basin increase rainfall and retard evaporation.

Owing to its many branches which rapidly gather the rainfall from their steep valley sides, the Ohio is subject to severe, and sometimes disastrous floods. Where lakes are present, as with the St. Lawrence, the discharge is equalized and the danger of floods lessened.

According to tradition, the Ohio was discovered by LaSalle, a French Jesuit, in 1669. It is said that he had been gathering information concerning it for several years from the Iroquois, and finally reached it by way of Niagara and Cattaraugus Creek, one of the sources of the Alleghany. With canoes launched on the upper waters of the Allegheny in autumn, the discovery of the Ohio naturally followed. He explored the country as far as Louisville, and turned back, believing the river to empty into the Gulf of California on the Pacific coast.

The first steamboat west of the Alleghanies sailed on the Ohio, leaving Pittsburg October 29, 1811, bound for New Orleans. This was nearly four years after steamers had been plying regularly between New York and Albany. The river is noted also for being the dividing line between slave and free territory before the civil war. The country on both sides of the river was the scene of many exciting events, both before and after the war. Slaves who had escaped across the river were assisted in their efforts to gain freedom by the citizens of Ohio; on the other hand, many Southern sympathizers on the northern side of the river assisted in their capture and return.

Southern Ohio was much excited during the war, and was once invaded by General Morgan, the famous guerrilla, who entered the State by way of Indiana. He was finally defeated and captured near New Lisbon. The defeat of Bragg in Kentucky lessened the danger of invasion. The first structures of the present site of Cincinnati were two block houses built by a detachment of United States troops. No settlement was made, however, until December, 1788, just eight months after the settlement of Marietta, the first in the State. For two years the place was known as Losanteville, when it was changed to Cincinnati.

Louisville, the second city in importance in the Ohio valley, like Cincinnati, owes its location to the advantages which the river originally afforded; but to-day both cities profit more largely from the surrounding agricultural districts and the railroads leading to them. The soil throughout the whole valley is fertile and well adapted to the cultivation of grain. The scenery is beautiful where in the state of nature, but nowhere picturesque or wild

RIVER PLATTE.

The Platte, or Nebraska river, is an affluent of the Missouri river, and is formed by the junction in the west central Nebraska of the North and South forks, which rise among the Rocky Mountains, in South Colorado, and are some 800 and 550 miles long, neither of them being navigable. The general course of the Platte is eastward, in a wide shallow stream, over the treeless plains of Nebraska, till it reaches the Missouri after a winding course of about 450 miles. With its forks it drains some 300,000 square miles, but like them it is not navigable.

THE AMAZON.

The Amazon is the chief river of South America, and the largest in the world, whether regarded as to its volume, its length, or the extent of its basin. It is formed by the union of the Tunguragua and Ucayalo; the former rising in Lake Lauricocha (Peru), and the head stream of the latter, the Apurimac, originating about latitude 16 degrees south, longitude 72 degrees west. Here the stream has depth sufficient for almost any class of ships.

Thenceforth the Amazon flows generally east through the Brazilian territory, to the Atlantic, which it enters nearly under the equator its estuary widening until it is 180 miles across. Taking the Apurimac as its source, its direct length is estimated at 1769 miles; and including its widening nearly 4000 miles for great part of which it is navigable and uninterrupted by any rapid or cataract.

At least twenty noble rivers, navigable to near their sources, pour their waters into it, besides numerous other less important streams. The extent of its basin has been computed at 2,000,000 square miles, or about the two-fifths of the whole continent of South America. The estuary of the Amazon was discovered by Pinzon in 1500; in 1539 Francisco d'Orellana sailed down it from the Napo, and it obtained its name of Amazon from his having reported that he had seen armed women on its shores.

THE FAMOUS NILE.

This large and celebrated river of Africa is formed by the confluence of two great branches, the Bahr-el-Azrek, or "Blue River" (often called the Blue Nile), and the Bahr-el-Abiad, or "White River" (White Nile). The first-mentioned arm rises in Abyssinia, and taking a north course through the Lake of Dembea, joins the Bahr-el-Abiad at Khartoum, after being in some places broken by cataracts. The White Nile (so named from the milky color of its waters) has been traced as far to the southwest of the continent as north latitude 10 degrees, east longitude 20 degrees,

The real sources of the Nile were, until recently, supposed to lie in Lakes Victoria N'yanza and Albert N'yanza, discovered by the English explorers Grant and Speke. In June, 1872, however, intelligence received from Dr. Livingstone, the famous African explorer, stated that he had arrived within 180 miles of the Chambesi River, where he had reason to believe lay the springs of this mysterious stream. After the union of the two branches at Khartoum, the Nile forms one grand main river, taking a generally winding course north as far as Edab, in Dongola, where it forms what is called the Great Bend.

Thence flowing through a country rich in architectural trophies of the past, and rendered highly fertile by its annual inundations, the Nile empties into the Mediterranean by a delta of seven mouths, of which that of Rosetta, the principal one, has a width of 1800 feet, with a depth of 5 feet in the dry season. Total length, 3500 miles from Victoria N'yanza, or 4500 miles from latitude 12 degrees south.

THE VOLGA.

Volga, or Wolga, a great river of Eastern Europe, taking its rise in Lake Seligher, near the Valdai Mountains in the Russian Government of Novgorod, and, taking a winding course east and south, finally empties into the Caspian Sea by a delta of some 70 mouths, after a total flow of 2400 miles, during which it drains an area estimated at 397,000 square miles.

It abounds with fish, and is frozen over during winter. In times of flood, it is navigable for vessels of considerable size as high up as Tver. On its banks are the cities of Kostroma, Simbirsk, Saratov, Tsaritisin, and Astrakhan.

THE YENESEI.

This is a river of Asiatic Russia, having its source in Mongolia, and, passing north through Liberia, falls into the Arctic Ocean, 200 miles east of the Obi, after a total course of 2300 miles.

HOANG-HO.

Hoang-ho ("Yellow River"), or simply Ho, one of the principal rivers of China,

more than 3000 miles in length, rises in the plain of Odontala, south of the Kuen-Lun Mountains, and has a tortuous course. From the southernmost corner of the province of Chih-li, which it crosses, the Yellow river flowed until recently eastward of the ocean, 650 miles distant, but in 1851-53 this wayward and turbulent stream, which is said to have shifted its course nine times in 2500 years, turned off near Kaifung-foo in a northeasterly direction. Since then it discharges its waters into the Gulf of Pechili, some 500 miles north of its former mouth, the mountainous province of Shan-tung lying between the two.

The river is little used for navigation, Chinese vessels being unable to stem its impetuous current. In some parts of its eastern course, as in the case of the Po, the river-bed is above the great plain through which it passes. The embankments requisite for avoiding inundations are a source of never ending expense to the government, and their yielding to floods a frequent cause of desolation to extensive districts of country. In 1887, by a dreadful inundation in Ho-nan, "China's sorrow" destroyed millions of lives. The measures subsequently taken by the Chinese Government to regulate the course of the river proved futile.

About 170 miles of the upper course of the Hoang-ho were explored for the first time by Prejevalsky in 1880. The vast quantity of sediment conveyed to the sea by this river, giving it its color and name, is taken up in that part of its course which lies between the provinces of Shan-hsi and Shen-hsi beyond which its waters are remarkably clear, all the sediment having settled to the bottom.

DANUBE RIVER.

A great river of Central Europe, taking second rank after the Volga. It rises in the Schwarzwald, grand-duchy of Baden, and, after passing through the States of Wurtemberg, Bavaria, Austria, Hungary, Roumania and Bulgaria, empties into the Black Sea by a delta of several arms, the chief of which is the Sulina. Total length, estimated at 2400 miles. The Danube receives, as its chief affluents, the Inn, Leitha, Save, Raab, Drave, Pruth and Theiss, and is navigable by steamboats to Pesth. Since 1856 its navigation has been declared free under the protectorate of Austria, England, France and Turkey. This river formed for ages the northeast limit of the Roman Empire.

RIVER EUPHRATES.

This is a famous river of West Asia, rising by two forks in Armenia, and taking a course east and south till at Kurnah it is joined by the Tigris. It thence takes a southeast course to its embouchure by a delta into the waters of the Persian Gulf. Total length, 1800 miles; area of basin of main stream and tributaries, 108,000 square miles. It is subject to annual inundations, and is navigable for a distance of 1195 miles from its mouth.

RIVER GANGES.

Ganges, a famous river of India, considered a sacred stream by the Hindoos, which rises in the high region of the Himalaya, and, leaving the mountains at Hurdwar, flows 1557 miles, with a smooth, navigable stream, through delightful plains, to the Bay of Bengal. It receives numerous important affluents, chief of which are the Goomtee, Jumna,

and Ramgunga, and has on its banks the great cities of Rajmahal, Patna, Benares, Allahabad, Ferruckabad, Cawnpoor, Jessore, Chardernagore, Dacca, Moorshedabad, Calcutta, etc.

Its mouth forms a delta extending 200 miles north of the Bay of Bengal, which region is a malarious, jungly tract, infested by tigers, etc. Of the two chief arms of this delta, that of the Hooghly conducts up to Calcutta.

The Longest Rivers in the World.

NORTH AMERICA.

Name.	Miles.
Mississippi	4,400
Missouri	3,130
Mackenzie	2,800
Rio Bravo	2,300
Arkansas	2,070
Yukon	2,000
Red River	1,520
Ohio and Allegheny	1,480
St. Lawrence	1,450

EUROPE.

Volga, Russia	2,400
Danube	2,400
Rhine	840
Vistula	700

ASIA.

Yeneisy and Selenga	3,580
Kiang	3,290
Hoang Ho	3,040
Amoor	2,500
Euphrates	1,900
Ganges	1,557
Tigris	1,160

AFRICA.

Nile	4,500
Niger	2,400
Gambia	1,000

SOUTH AMERICA.

Amazon	4,000
Rio Madeira	2,300
Rio Negro	1,650
Orinoco	1,600
Uruguay	1,100
Magdalena	1,000

MOTOR WAR CAR

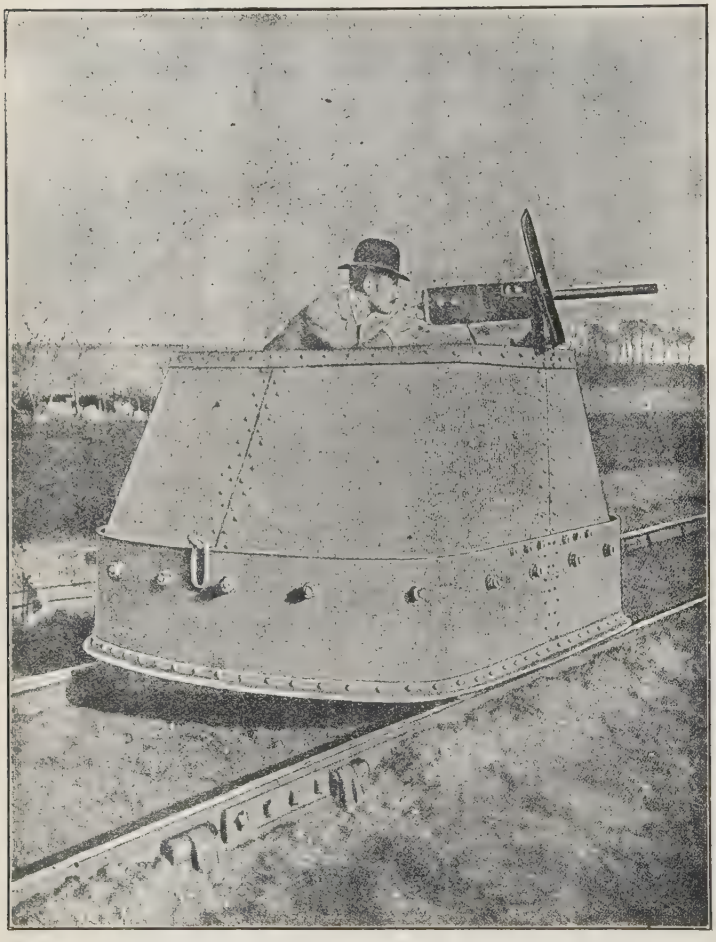
A Battery on Railway Wheels—How it is Made to Travel.

A MOTOR war car for the protection and inspection of railway roads has been designed by Simms, the eminent engineers. Its objects in time of peace are the inspection of the permanent way for sending despatches, as well as to serve as a pilot to ordinary trains. In case of war it is intended for the protection of railway lines and to keep up a continuous communication.

Armor-plated and carrying a one-pounder Maxim gun and a small machine gun, each car forms a little self-contained fort ready to start at a moment's notice and capable of a speed up to thirty miles an hour. Each car is manned by one officer and two or three men, and it is thought possible that a railway line extending over 500 miles could easily and efficiently be held by twenty-five of these

machines, or 100 officers and men, each car having an area of twenty miles.

Here are some facts about it: The car is propelled by a seven-horse power Simms water-cooled motor which is entirely automatic in action. It produces its own igniting spark by means of a magneto-electric machine, can be started at a moment's notice, and is fed by petrol or ordinary petroleum. Owing to the absence of any open flame no danger from fire or explosion exists.



ARMORED CAR USED IN THE SOUTH AFRICAN WAR.

The armor is constructed in two parts, the under and upper part, the latter being of a crinoline shape. The under part of the armor protecting the machinery is constructed of heavy Vickers nickel steel plates. Owing to great care in the design and construction having been used the car runs practically silent and without vibration, thus enabling accurate aim even whilst traveling at a high speed.

Sufficient room has been allowed for about 40,000 rounds for the ordinary machine gun, and the oil tanks contain sufficient fuel for 200 miles. At night a search light may be worked in connection with the engine. The total weight of the vehicle complete with armor is twenty-eight hundred weight.

Of late years there has been great competition in inventing implements of war. A large part of the world's mechanical genius has been employed in this way. We have the ghastly spectacle of weapons of destruction which are the outcome of the inventive genius of modern times. Their object is the very worst known to man, and that is the slaughter of man himself. There are guns that have become famous because at one discharge they can cut a windrow through solid regiments and drench the battlefield with the blood of scores of combatants.

QUEEREST OF GAMBLING GAMES

WHO or what is this "Lloyds" that figures almost daily in the cable despatches printed in American newspapers? The uninitiated have been puzzling deeply over the question since it was announced that the concern had insured King Edward's life for six days from the date of his surgical operation.

Don't be astonished at anything you read about the "Lloyds'" system of insurance. They haven't any system. The concern is the most remarkable, incomprehensible, unconservative, happy-go-lucky, ragtime institution in John Bull's domains.

"Lloyds" will take a chance on anything, from the genuineness of an alleged Panama hat to the number of minutes a stricken monarch can cling to life. "Lloyds" is the most gigantic betting institution in the world.

Parliamentary attention was called to the queerness of its proceedings long ago, but as a commission appointed to investigate could not find cause to condemn the methods employed, "Lloyds" continued to flourish and stake money on the most extraordinary risks, losing heavily at times, but, like most professional gamblers, winning largely in the long run.

"Lloyds" sprung into existence early in the seventeenth century. It owed its origin to the fact that one Edward Lloyd kept a coffee-house in Tower street, where sea captains and ship owners congregated to talk "shop." Gradually the coffee feature was eliminated, and the place was given up entirely to speculation on the fate of ships and cargoes in transit.

There were seventy-nine members of this original Lloyds, and their method was to risk a certain sum on the safe arrival of an incoming or outgoing vessel. If the ship reached port safely, the merchants who had assumed part of the risk received a percentage of the profits in accordance with the amount they had agreed to pay in the event of disaster.

From this coffee-house origin grew the immense association known to-day simply as "Lloyds," numbering nearly a thousand members, and prepared to insure anything on which there is a prospect of winning a reasonable premium. The members do business on their own account whenever they please, the association merely stipulating that each shall deposit $25,000 as a guarantee of financial responsibility. Here are some of the odd things on which members of the great gambling association have taken a chance:

Insured the life of Napoleon for one month at a premium of 3 per cent.

Guaranteed the owners of "Jumbo," the big circus elephant, against loss in

case he died on the voyage from England to America.

Agreed to pay a famous singer the cost of her gowns in case Queen Victoria died before a series of concerts were given.

Insured a glass bed packed in twenty cases and shipped to an Oriental potentate.

Guaranteed promoters of cricket and foot-ball matches against loss through bad weather.

Guaranteed the Prince of Wales' jubilee stamps would be a popular issue.

Insured a milliner against loss in case an electric light pole fell and broke her plate glass windows.

Made bets with prospective parents against the progeny proving to be twins.

During the late queen's golden and diamond jubilees all the standowners, decorators and florists who stood to lose heavily in case the queen died or was taken ill before the great event came off, rushed to Lloyds and shifted the burden to that great association of willing gamblers.

Lloyds were the chief losers when the coronation festivities of King Edward were canceled. The betting on the king's being able to go to Westminster Abbey on the day appointed was 100 to 30. The underwriters are said to have lost at least a million dollars by the postponement of the ceremony. Such is Lloyds!

WHAT THE WORLD PAYS FOR THE LUXURY OF RULERS

A KING in his palace is a very glorious spectacle, indeed, to many European eyes, but the luxury "comes high." It is a curious fact that the smaller the nation the larger, as a rule, is each citizen's contribution toward his ruler's support. The individual Turk pays about $1.25 per annum to uphold the might, majesty and power of Abdul Hamid, while Mr. Roosevelt costs each citizen of the United States about one-twelfth of a cent yearly.

Considering that Washington, the governments of several States, and local societies and clubs, expended $300,000 for entertaining the brother of the German emperor during two short weeks, it's not to be wondered at that Europe is groaning under the burden of the enormous civil lists of salaries paid to royalty.

The Kaiser, in his capacity of King of Prussia, is the highest paid ruler in Germany. He receives diverse salaries as an army officer and colonel of a dozen or more regiments; also about half a million for charitable purposes. All told, his income from the State foots up to more than $4,250,000 per annum.

The other German States pay their

sovereigns proportionally high. Lippe, for instance, has a population of less than 140,000, and is so insignificant as a body politic that, when the country craved annexation by Prussia, in 1866, Bismarck offered to send a county commissioner to administer the government at a salary of $1000 per year. Yet his serene highness collects $50,000 per annum, merely because his family has been living on the fat of the little land for so many hundred years.

Over $100 an Hour.

The question of the civil list in Great Britain is not yet fully settled, and in the meanwhile King Edward is compelled to scratch along on the sums granted to his mother, namely, an assured annual income of $1,925,000 and revenues from the Duchy of Lancaster of $300,000. This gives him $115 every hour, but he hopes to have his meagre allowance increased in proportion to his needs, which are quite formidable.

At any rate every English man, woman or child contributes 7½ cents toward the maintenance of the king annually, not counting the pennies he or she furnish to keep the royal princes and princesses and their young ones going. These 7½ cents look rather inconsiderable compared with the 20 cents extracted in the "Fatherland," particularly when it is remembered that the Germans have very large families as a rule.

Practically the czar has the power to revert to his own uses any portion of the State revenues that suits his fancy. But Russia has not in vain been called an "autocracy tempered by assassination." If the "Little Father" assumed too much his assistants in the governing business might get jealous and batter his brains out, as they did with Paul, or poison or stab him to death, as they did with various Peters, Alexanders, Annas and Catherines.

Assuming that the St. Petersburg Statesman's Year Book can be relied upon Nicholas takes four and a quarter cents annually from each of his subjects—but though he has nearly 107,000,000 of them, the official excuse-maker figures his income from the empire at $5,000,000 per annum only, while other sources state it to be twice as much. It should be added, though, that the State places 1,000,000 square miles of cultivated land at Nicholas' disposal, besides gold and silver mines yielding a fortune every day in the year.

King George of Greece.

It's the festive toy kingdom that pays its ruler best, proportionally, of course. Greece, one of the poorest countries in Europe, gives George $200,890 annually—eleven cents per head of the population. But that isn't enough for this lusty king. George couldn't live on such a paltry sum. The governments of Great Britain, France and Russia therefore add to his pay $20,000 each, thus raising his income to $260,890. When George was still a junior prince in Denmark he earned fully $50 per month, and it's said his thrifty countrymen begrudged him even that little, calling him a "useless dunce."

Belgium, which is rich, pays no more to Leopold per head of population than Greece to its ruler, but Belgium is the most over-populated country in Europe.

The Emperor of Austria, though enormously wealthy in his own right, still has

the hardihood to tax every one of his subjects ten cents per annum for keeping the dual empire from falling into anarchy. Still, if after his death the long expected crash comes, his subjects may think that he accepted scab wages at that.

A Generous Ruler.

Nine and a half cents is what the Italians pay their king, every one of them, not forgetting daughters. Victor Emanuel himself thinks the amount excessive, and he memorialized his Parliament to cut down his allowance by a million or two francs, if you please. Seeing that he receives three million dollars for maintaining Italy as a second or third rate Power with first rate pretensions, it seems no great hardship that he be docked $200,000 or $400,000. That money, well invested, might save thousands of poor Italians from starvation; but it's more likely that the government will fritter it away on war vessels that can't swim or in colonial undertakings that benefit the pockets of transportation companies and "rings."

The loyal Swedes are taxed at the rate of eight and a half cents per head of population for the benefit of their king, to whom they pay $345,330 per annum, all told, but the Norwegians make their allowance dependent upon Oscar's good behavior. At the present time they give him less than $100,000, but if he continues to obstruct their national policy they may cut off his income from Norway altogether.

That will probably happen anyhow when Oscar's unpopular eldest son, Crown Prince Gustaf, mounts the throne. Gustaf has repeatedly indulged in threats against the Norwegians, and they have made a note of it, for, next to maintaining a state of hostility with Sweden, they like nothing better than to punish their king for presuming too much.

Proverbially poor Spain still manages to pay its boy ruler $1,850,000, exclusive of allowances to the royal family that amount to no less than $2,000,000 per year. All told, the Spaniards pay over $3,000,000 per annum for the fun of seeing a feeble-minded boy occasionally ride out at the head of a troop of cadets. Among the royal beneficiaries of this remarkably liberal nation is old Queen Isabelle, who, with her imbecile husband, was chased out of Spain as long ago as 1868. She has been a public charge at the rate of $210,000 per year ever since—this after ruining Spain by her extravagance during a reign of thirty-five troublesome years.

Royal Poverty.

Probably no Spaniard, Monarchist or Republican, would begrudge the king his salary if it wasn't for the fact that so little of it finds its way to the coffers of loyal subjects. The Queen Regent, it is said, turns around every peseta half a dozen times before spending it, and who can blame her? It's bad enough to be an ex-king, argues her Majesty, but to be an "ex" and poor must be awful, indeed.

Like Spain, bankrupt Portugal thinks it a wonderfully pleasant thing to feed a lot of royal paupers. She gives her fat king $410,000 per year, and to this sum adds $150,000 for members of his family, among them one king who was ignominiously expelled from the country many years ago. The former king draws one-

fourth of his former pay, just as Milan was continued on the Servian salary list after being forced to abdicate. Milan's worthy offspring, by the way, Alexander, earns $240,000 per annum—not bad for the grandson of a swineherd!

Republics are notoriously "bad pay," to use an English expression. We Americans, for instance, contribute to the maintenance of the White House and its occupants no more than one-twelfth part of a cent per head, but the Swiss people are even less liberal. The salary paid Mr. Roosevelt would keep six Swiss presidents going, with a few thousand dollars to spare for extras.

France treats her president as well as the Netherlanders do their queen. Wilhelmina receives $250,000 per annum, and President Loubet gets as much, which means that every Frenchman contributes a fraction over one-half cent towards the maintenance of the head of the State.

THE STARS AND STRIPES

Historic Flags—Betsy Ross and the Star Spangled Banner.

ALTHOUGH the United States is one of the youngest nations of the world, its flag is one of the oldest among the Powers. The country's standard, with its thirteen stars and stripes, which was first unfurled June 14, 1777, has remained practically unchanged through the progress and growth of the country of which it saw the birth.

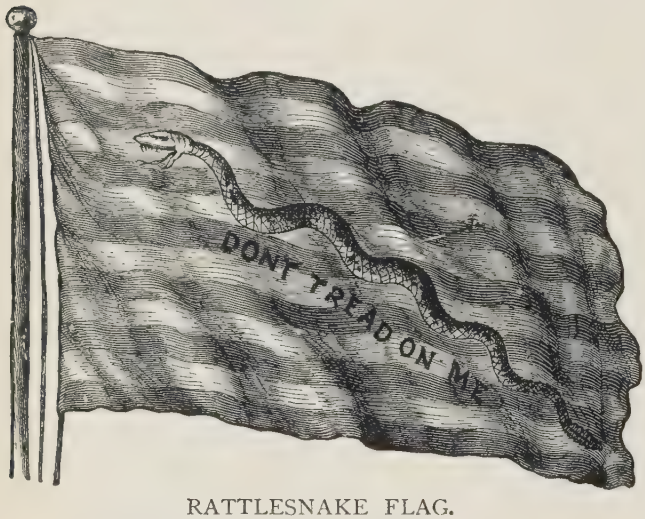
The star-spangled banner which now floats over Uncle Sam's possessions on lands and seas, is unaltered, with the exception of the number and arrangement of the stars, from the one which Betsy Ross, at General Washington's request, made at her home, No. 239 Arch street, Philadelphia. That is why we celebrate June 14 as "flag day."

In 1606 Scotland was added to England, and King James I., in honor of the union placed the white cross of St. Andrew on the national flag, changing the field from white to blue. This union of the two crosses was called the "King's colors" or "Union" colors, and the first permanent settlements in this country were made under its protection, and the "King's colors" were generally unfurled by each new body of explorers who came from the mother country to the New World, until, in 1707, we adopted the red flag, but added to it a device of our own in place of the crosses.

The device of a rattlesnake was popular among the colonists, and its origin as an American emblem is a curious feature

in our national history. It has been stated that its use grew out of a humorous suggestion made by a writer in Franklin's paper—the Pennsylvania Gazette—that, in return for all the wrongs which England was forcing upon the colonists, a cargo of rattlesnakes should be sent to the mother country and "distributed in St. James Park and other places of pleasure."

Colonel Gadsden, one of the marine committee, presented to Congress on the 8th of February, 1776, "an elegant standard, such as is to be used by the commander-in-chief of the American navy," being a yellow flag with a representation of a rattlesnake coiled for attack.



RATTLESNAKE FLAG.

Another use of the rattlesnake was upon a ground of thirteen horizontal bars, alternate red and white, the snake extending diagonally across the stripes, and the lower white stripes bearing the motto: "Don't Tread on Me." The snake was always represented as having thirteen rattles. One of the favorite flags also was of white with a pine tree in the centre. The words at the top were: "An Appeal to God," and underneath the snake were the words, "Don't Tread on Me." Several of the companies of minute men adopted a similar flag, giving the name of their company, with the motto, "Liberty or Death."

Massachusetts clung to the pine tree as her symbol for some time. Trumbull, in his celebrated picture of the "Battle of Bunker Hill," which now hangs in the rotunda of the Capitol at Washington, represents the red flag, white corner and green pine tree.

The Connecticut troops, who took part in the exciting times that followed Lexington and Bunker Hill, had a State banner with the State arms and motto, "Qui transtulit sustinet." The troops of Massachusetts adopted the words "An Appeal to Heaven." Early New York records speak of different standards; indeed, the regiments from the different States, hastening to Washington's aid, flaunted flags of numerous devices, some having only local interest and being only used on the occasion that originated them.

In October of 1775 Washington wrote to two officers who were about to take command of two cruisers: "Please fix on some flag by which our vessels may be known to each other." They decided on the "Pine Tree" flag, as it was called, and so the pine tree was hoisted at sea as American colors.

The first striped flag was flung to the breeze in America at Cambridge, Mass., Washington's headquarters, January 2, 1776. It had thirteen stripes, alternate red

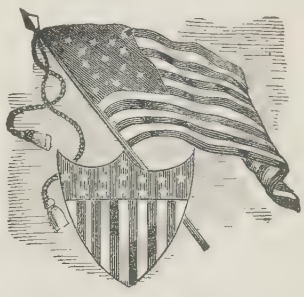
and white, and the united crosses of St. George and St. Andrew on a blue field. When reported in England it was alluded to as the "thirteen rebellious stripes."

In 1775 a navy of seventeen vessels, varying from ten to thirty-two guns, was ordered. The senior of the five first lieutenants of the new Continental navy was John Paul Jones. He has left it on record that the "Flag of America" was hoisted by his own hands on his vessel, the "Alfred," the first time it was ever displayed by a man-of-war. This was probably the same design as the Cambridge flag used in January, 1776.

We now come to the time when the crosses of St. George and St. Andrew were taken from the Union flag and a blue field with white stars substituted for the symbol of English authority. One hundred and twenty-five years ago this June 14th the American Congress, in session at Philadelphia, resolved "that the flag of the United States be thirteen stripes, alternate red and white; the union to be thirteen stars, white, on a blue field, representing a new constellation, the stars to be arranged in a circle."

There are many traditions afloat concerning the origin of this design, but the one in which there is undoubetdly the most truth is that which credits the idea of the design to Washington. The general found in the coat-of-arms of his own family a hint from which he drew the design for the flag. The coat-of-arms of the Washington family was two red bars on a white ground, and three gilt stars above the top bar. The American flag, once decided upon, was rushed through in a hurry, for the army was badly in need of a standard.

Betsy Ross enthusiastically undertook the work, and in a few days a beautiful star-spangled banner was ready to be unfurled. She had made one alteration in the design submitted by Washington. The general had made his stars six pointed, as they were on his coat-of-arms. Betsy Ross made her stars with



FLAG AND SHIELD.

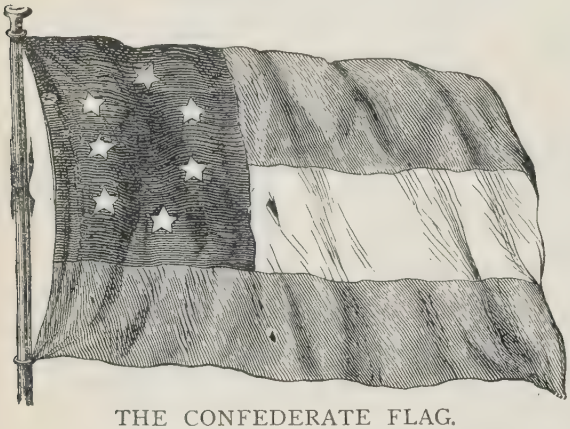
five points—and five points have been used ever since. For several years Mrs. Ross made the flags for the government.

The first using of the stars and stripes in military service, it is claimed, was at Fort Stanwix, renamed Fort Schuyler, now Rome, New York, 1777. August 2d of that year the fort was beseiged by the English and Indians; the garrison was without a flag, but one was made in the fort. The red stripes were of a petticoat furnished by a woman; the white for stripes and stars was supplied by an officer, who gave his shirt for the purpose, and the blue was a piece of Colonel Peter Gansevoort's military cloak. Three women worked on the flag, and it was raised to victory on the 22d of August, when the red men and the English were defeated at the fort.

The next record of the using of the Stars and Stripes is on the first anniversary of American Independence, which was celebrated at Philadelphia, Charles-

ton, S. C., and other places, July 4, 1777. The banner was used at the battle of the Brandywine, September 11, 1777; at Germantown, October 4th of the same year, and it also floated over the surrender of Burgoyne. This flag cheered the patriots at Valley Forge the next winter; it waved at Yorktown and shared in the rejoicings at the close of the war.

Some of the first flags were made under difficulties and at great cost, the greatest



THE CONFEDERATE FLAG.

ingenuity being required on occasions to secure the necessary materials for the banners. History tells us that Madame Wooster and Mrs. Roger Sherman made the first national flag for the Connecticut troops used in the army from their own dresses.

As long as the States remained thirteen in number the original design of the circle of stars was all right, but when, in 1791, Vermont and, in 1792, Kentucky were taken into the Union it was decided to arrange the stars in the form of one huge constellation.

In 1795 it was decided to add a stripe as well as a star for each State which came into the Union, consequently in that year Vermont and Kentucky were marked on the flag, one by a white and the other by a red stripe; but some wise prophet, looking ahead some twenty or more years, saw that this plan of adding a stripe as well as a star for each State added to the Union would mean a constant changing of the flag, which would in a few years, become so large and ungainly that its beauty would be entirely lost.

A committee in 1812 was elected by Congress to decide upon a permanent design for the flag, and the result was that the original thirteen stripes were again used, the stars arranged on the blue field in the form of a square, with one constellation for each new State. In 1818 this plan was formally adopted by Congress, and the flag, with its thirteen stripes and stars corresponding in number to the States in the Union, became the established emblem of America.

On the subject of a flag a committee of six was appointed, one from each State then represented in the Provisional Senate, who recommended under date March 5, 1861, that "the Flag of the Confederate States of America shall consist of a red field, with a white space extending horizontally through the center, and equal in width to one-third the width of the flag. The red spaces above and below to be of the same width as the white. The Union, blue, extending down through the white space, and stopping at the lower red space; in the center of the Union a circle of white stars corresponding in number with the States of the Confederacy.

It was first displayed in public March 4, 1861, simultaneous with the inauguration of Lincoln, and was unfurled over

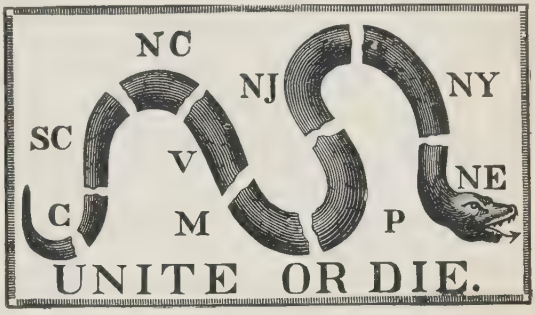
the State House at Montgomery, Alabama.

On the battlefield the flag bore such a similarity to the Union flag, that in September, 1861, for the Army of the Potomac (C. S. A.), Generals Beauregard and Johnson created what afterwards became known as "The Battle Flag;" a red ground with a blue diagonal cross emblazoned with white stars, one for each State. This form was adopted by all of the troops east of the Mississippi river.

The first design bearing objection of resemblance to the Stars and Stripes, and the battle flag having no reverse, the Confederate Senate in April, 1863, adopted a white flag, with a broad blue bar in its centre, amended by inserting the battle-flag design as the Union, with a plain white ground for the field. This arrangement afterwards proved faulty, as at a distance the large white field resembled a flag of truce, also as combined with the Union was similar to the English white ensign.

On February, 4, 1865, the Confederate Senate adopted a third change: "The width two-thirds of its length; with the Union now used as a battle-flag, to be in width three-fifths of the width of the flag, and so proportioned as to leave the length of the field on the side of the Union twice the width below it; to have a ground of red and broad blue saltier thereon, bordered with white and emblazoned with mullets of five-pointed stars, corresponding in number to that of the Confederate States. The field to be white except the outer half from the Union, which shall be a red bar, extending the width of the flag."

On the day the ordinance of secession was passed (December 20, 1860,) by South Carolina the convention adopted a banner for the Confederate States. It was composed of red and blue silk, the former being the ground of the standard, and the latter in the form of a cross, bearing fifteen white stars, divided, four stars each in the upper and lower arm and three each in the left and right arm, with a large star in the center representing



UNITE OR DIE FLAG.

South Carolina, the other stars those of her sister slave-holding States. On the red field were a silver palmetto and crescent.

The first local flag of the Confederate States was of a dull white bunting with a representation of a palmetto tree, with eight branches, no leaves, sewn in the center, surrounded by eleven stars and a red moon just rising. The flag was used on the fortifications of Charleston harbor.

The flag of the Confederacy was last officially flown on board the Confederate steam-cruiser "Shenandoah," which, after a cruise around the world, sailed into the harbor of Liverpool, England, in August, 1865, four months subsequent to the surrender of General Lee.

The Unite or Die flag was somewhat in vogue during the period when efforts were being made to unite the colonies against British oppression.

BEET SUGAR INDUSTRY

Its Immense Profits—How Sugar Beets are Utilized.

THE fight in Congress between the lobbies of the cane sugar and beet sugar interests directed the eyes of the world to the wonderful progress in the latter industry. Enormous profits for beet growers and beet refiners have attracted capital, and the industry has grown by leaps and bounds, doubling its output almost every year.

There are huge profits in beet sugar. The farmer raises twelve or fifteen tons of beets to the acre, and sells them for $4.50 a ton, thus receiving from $54 to $67.50, with his expenses ranging from $20 to $30 per acre. The refiner can manufacture his product and put it on the market at a lower price than the cane sugar people, and still reap a handsome dividend on the year's work. For a ton of beets, which cost $4.50, will produce 336 pounds of refined sugar.

The factory cost of refined sugar production is kept a secret by the Spreckelses, the Havemeyers and the Oxnards, but this much is public property. Refined sugar sells at 4.75 to 5.25 cents a pound from the refineries. Averaging this at five cents a pound, it will be seen that the product of a ton of beets (336 pounds) will sell for $16.80, which, less the cost of raw material, leaves $12.30 a ton for refining and profits for the refiner. Probably one-half of this, or $6, is the profit on a ton of beets.

It is small wonder then that the beet sugar people fought hard to exclude Cuban sugar and to prevent any diminution of the tariff.

The world ate 23,990,400,000 pounds of sugar in one year, and this is a fair average. Of this amount 15,366,400,000 pounds were the product of the sugar beet. The balance, 8,624,000,000 pounds came from sugar cane. In forty-eight years the production of cane sugar has increased 201 per cent. In the same period of time there has been an increase in the production of beet sugar of 3263 per cent.

It is probable that the spoonful of sugar with which you sweetened your coffee in the morning was the product of a beet grown in California or one of the Western States. Certainly you could not tell the difference between the refined products of cane and beet unless a test is made. There is one simple way for the curious housewife to determine what kind of sugar she is using, and we give it on the authority of H. W. Wiley, Chief of the Bureau of Chemistry of the United States Department of Agriculture.

Take two empty fruit jars. Fill one of them about a third full with powdered or granulated cane sugar and then put the same amount of beet sugar in the other. Close both jars and put them away for a week in the pantry. When they are

opened the cane sugar will have retained its sweet, appetizing odor, but from the beet sugar jar will come a rank, acrid smell which very much resembles that of the raw product during manufacture.

Apart from that there is absolutely no difference between cane and beet sugar. One is just as good as the other for household use.

Its Immense Cost.

The first sugar which is known to have gone to England was sent there in 1319 from Venice. Four hundred years later it was still a most costly luxury, being rated at $13.50 a hundred pounds. Even in 1800 the price had fallen only to $7.50 a hundred pounds. This enormous price for such a desirable article turned the attention of chemists to the necessity of finding a cheaper product.

Maargraf, a German chemist, discovered the sweet principle in the garden beet, and in 1797 one of his pupils, Achard, prepared beet sugar on a large scale—that is, he extracted several tons by a crude process, and announced that it could be made at a cost of six cents a pound.

Owing to the continental blockade during the Napoleonic wars, this discovery created the liveliest interest in Europe. For a long time no sugar had come in from the Indies or from Africa. Molasses and rum were scarce. So Napoleon appointed a commission from the French Academy of Sciences to investigate the process.

When a favorable report was submitted to the great general he set to work at once to develop the industry in France. During his regime he founded the manufacture of beet sugar on such solid ground that it has since flourished not only in France, but all over the world.

It was believed only a few years ago that only mid-Europe, including Germany, Austria, France, Belgium, Holland and part of Russia, could produce sugar. Now Denmark and Sweden must be included. Hungary and Southern European States have become connected with the industry, and now produce enough for their own consumption. Spain, Italy, Roumania, Bulgaria, Greece and the Levant have begun to export the surplus of their beet sugar. Siberia is growing sugar beets; Persia has entered the market. Egypt, Chile, the Barbados and South Africa are cultivating the root successfully.

Amount of Product.

In the United States the American, with characteristic push and energy, has brought the cultivation of the beet and the manufacture of the sugar to a high state of perfection. In the latest available year for reports we produced 185,000 tons, an increase of 140 per cent. over the 77,000 tons of the previous year. This is but a drop in the bucket, when compared with the total consumption of the country. The normal quantity of sugar that this country uses in a year is 2,372,316 tons, or about seventy pounds a year for every man, woman and child.

The first effort to manufacture beet sugar in this country was made near Philadelphia. This was in 1830, and the attempt proved a failure on account of the character of the beets grown in this part of the country. Further attempts made at Northampton, Massachusetts; at Chatsworth, Illinois, and Freeport, Illinois, in

1863, were also failures, and it was not until the Alvarado refinery was built in California in 1870 that a commercial success was made of the business. Then the Oxnard Brothers took hold and established immense refineries, becoming to beet sugar what Claus Spreckels was to cane sugar and what P. D. Armor was to beef canning.

Refined Sugar.

All beets have the saccharine principle, but few of them have in quantity sufficient to permit the successful manufacture of refined sugar. Peculiar soil and atmosphere are required to produce the sugar beet. When the farmers harvest their crops they take them to the refinery. There they are stored in huge V-shaped bins until turned into sugar. When all is ready the beets, a ton at a time, are carried to spiral washers, where they are tumbled about and thoroughly cleansed of all dirt and impurities.

Thence they pass to the elevator, which takes them to the cutter. By means of ten revolving V-shaped knives this device cuts them into ribbons that go under the name of "cossetts." The purpose of this slicing is to open every cell in the beet without bruising it. The cossetts then pour through revolving spouts into diffusion batteries. Each battery contains fourteen cells, and each cell holds about two and one-half tons of cossetts.

Hot water is forced from one cell to another until, by passing through nine cells, it has reached the required density by soaking up all the sugar principle. The water is then turned off from cell No. 1, which is recharged with cossetts, and cell No. 2 becomes cell No. 1, and cell No. 10 becomes No. 9. This enables a continuous working of the batteries and prevents loss of time.

The liquid has by this time become an evil-looking, foul-smelling fluid, but it is full of sugar. The liquid, after passing through a measuring apparatus, which registers its density, goes to a receiving tank, from which it is distributed to carbonators. In the first carbonator the juice is treated with milk of lime, and then precipitated by carbonic acid gas.

In the second carbonator practically the same process is repeated, and the alkaline quality of the fluid is increased. The juice is then forced through a series of filters made of finely-woven burlap. It is now a clear white, free from all impurities and ready to be crystallized.

Process of Making.

The first process in crystallization is to evaporate the surplus water, and special machines and retorts are used for this. Then the circulated juice is boiled in a machine, called the "strike pan," under a vacuum until it "grains." When it reaches this stage it is called "massecuite," and closely resembles candy before it has hardened. From the strike pan to the crystallizer is the next step. This machine requires the most careful and skilled work. The massecuite must be made to yield a large percentage of sugar crystals by thoroughly and uniformly agitating the mass and by a delicate and timely control of the temperature.

The crystals having formed, the wet mass is sent to centrifugals, huge drums with perforated sides, which, revolving rapidly, throw out the water and retain the granulated sugar. When the water has been extracted from the mass the

crystals are taken to the drying room, where the last fraction of a per cent. of moisture is removed by dry heat, and the glittering, snowy mass pours through tunnels into barrels and is shipped to the consumer, ready for use.

FASTEST BATTLESHIP

The New "Maine" a Marvel of Strength and Speed—Largest Ship in American Navy—Requires a Crew of 551 Officers and Men.

ALL speed records for American battleships were broken by the new "Maine," when she left Cramp's yard, Philadelphia, for her builder's trial off the Delaware capes. As she came up the Delaware river at night, on her return, her decks bore figures indicating that she had made 18.29 knots on the run.

These figures, while showing the "Maine's" best speed over the measured course, do not indicate her greatest burst of speed. For thirty minutes she ran at a speed of 19.95 knots, as indicated by the revolutions of her screw, 125 a minute. The trial indicated that, barring accident, the "Maine" easily exceeds the contract speed of 18 knots an hour.

The course over which the test was made was laid southeast of east from the Overfalls Lightship, and at twenty minutes after seven o'clock in the evening the patent logs were astern and the race against time began. Forty minutes after the trial started, the log indicated a speed of 17.36 knots, which, considering the newness of the engines, was surprising to those who were watching the work of the big ship. The speed record indicated was 19.5 at half-past eight o'clock, and between that time and nine o'clock the "Maine" had attained a speed of 19.95 knots.

The "Maine's" principal test, however, was for the run of 30 knots, which the ship made in one hour and thirty-eight minutes, an average of 18.8 knots per hour. This was done with no straining of the engines, and the ship ran remarkably smooth throughout.

As the weather was ideal for the trial, the sea being calm and a light northwest wind blowing, it was decided to push the ship seaward as fast as she could go. She steamed seaward until a quarter to ten o'clock, when her engines were stopped and she lay quiet for the night.

Observations in the morning showed that she was twenty-two miles southeast of the lightship, on Five Fathom Bank. The course was then laid for Overfalls Light, which was reached at half-past nine o clock.

The test over the measured course followed, and, though it was in shoal water and the bottom of the ship was far from being as clean as it should be

for an official trial, and the coal not of the best steam-making kind, the "Maine" showed a speed of 18.29 knots.

The patent logs used on the run, in which she made 18.8 knots, were tested over the measured course and found to be accurate.

Remarkable Speed.

Experts who were aboard the battleship are convinced of her remarkable speed ability, and there is but one opinion as to her meeting the speed requirements of 18 knots when her official trial occurs, off the New England coast. A naval officer who watched the work of the trial of the new ship expressed the opinion that she is easily an 18¼ knot ship. He was inclined to think that the speed made over the measured course, 18.29 knots, is a fair indication of her ability. The burst in which, for half an hour, she showed speed of 19.95 knots an hour, he thought was remarkable.

Another expert who was on the trip said that he has no doubt that the "Maine" would make 18½ knots an hour on her official run. The next fastest battleship in the navy, the "Illinois," showed 17.44 knots, so that, should this prediction be verified, the "Maine" will be a full knot faster than any other ship that has thus far had its trial. The machinery of the "Maine," including steering gear, worked excellently throughout the trip.

In recent years, during the discussion in Congress about the type of warship best adapted to the needs of the United States Navy, there has cropped out serious divergence of opinion as to the speed of battleships. Sometimes officials in the Navy Department have advocated 16 knots as the speed to be aimed at for the heavily armed battleships. These men were experts, and the reason they deprecated the straining for speed was that they did not wish to sacrifice the fighting ability and the steaming radius to speed, however desirable speed may be. In the "Maine" and ships of the type which the Navy is building now, all the desirable ends seem to have been attained. The "Maine" is swift and formidable.

The old "Maine," destroyed in Havana harbor, in 1898, was a second-class battleship of 6682 tons displacement. The new "Maine" will have a displacement of 13,500 tons when fully armored, armed and equipped, and is the largest ship in the navy. The battle-ships authorized in 1899 will equal the "Maine" in size, and ships authorized by later acts will exceed her, while the battleships authorized at the recent session of Congress are to have a displacement of 16,000 tons.

Her Armor Belt.

The "Maine's" protective belt of armor, 7½ feet high, is 12 inches thick to a line one foot below the water line, and then 8 inches thick. Above the heavy protective belt, which guards the vitals of the ship, the side armor is 7 inches thick. Her battery includes four 12-inch rifles and sixteen 6-inch rapid-fire rifles, beside the secondary battery of twenty 6-pounders, six 1-pounders, four Gatling guns and a field piece. She requires a crew of 551 officers and men.

When the old "Maine" was sunk, the United States had four first-class battleships, one of the second class, and two armored cruisers, the "New York" and "Brooklyn." Since then eight first-class

battleships, including the "Maine," have been launched, and fifteen others have been authorized.

Battle Ship Records.

Ship.	Speed.	Horse Power.
Alabama	17.103	11,366
Illinois	17.449	12,898
Indiana	15.547	9,738
Iowa	17.087	12,105
Kearsarge	16.816	11,954
Kentucky	16.897	12,318
Massachusetts	16.21	10,415
Oregon	16.79	11,111
Wisconsin	17.174	12,609

The "Maine's" contract calls for 18 knots speed and 16,000 horse power.

FIVE GREAT INVENTORS

Thomas A. Edison, the Wizard of Electricity—Robert Fulton, the Inventor of Navigation by Steam—James Watt, Inventor of the Steam Engine—George Stephenson, Famous for His Railway Locomotive—S. F. B. Morse, the Inventor of the Telegraph.

THE hard-headed men who have hammered iron, fused metal, studied nights, surmounted almost superhuman difficulties and have been laughed at, hooted, hissed and ridiculed, are the world's greatest benefactors. They have done more for the progress of humanity than the whole army of skeptics who have called them fools.

All great inventions have to fight their way. The history of inventors is a sad one. Possessed of some great idea, on which they had staked everything, they have shivered and starved and died to bring out their invention and make it known to the world. The next generation has built monuments to these men of shining bronze and whitest marble.

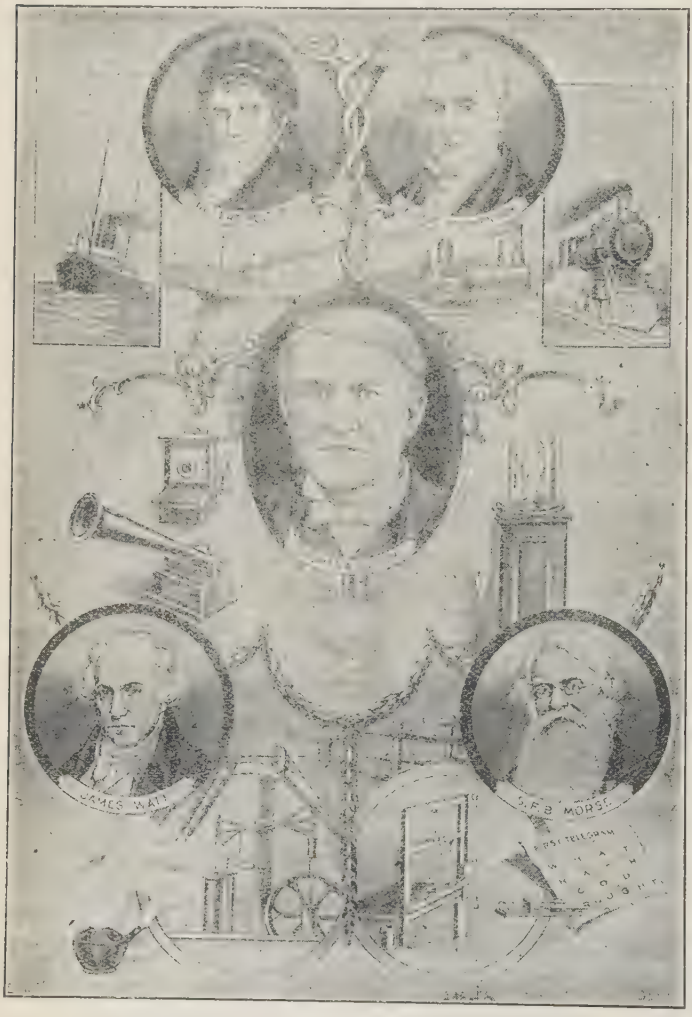
We take pleasure in presenting to the reader biographical sketches of some of the world's greatest inventors. They are the men who have made some of the latest and most marvelous scientific discoveries possible, while their own discoveries are the wonder of all men and must so remain.

THOMAS A. EDISON.

NO name in the realm of scientific discovery is more distinguished than that of Edison, more especially in that part of it which relates to electricity. We find him at the age of ten reading the histories of Gibbon and Hume, yet his biographers assert that he went to school only two months in his boyhood. Like the vast majority of those men who have left a deep impression upon their time, he was

born in poverty and obscurity, being conspicuously a self-made man. His education was under the direction of his mother, yet at best was but superficial.

Mr. Edison was born at Alva, Ohio,



FIVE WORLD-RENOWNED INVENTORS.

February 11, 1847. As soon as he was old enough to become interested in any study, he showed great fondness for chemistry. This indicated the bent of his mind, and was a prophecy that the natural sciences would be his favorite pursuit. While he was employed as a newsboy on a railway train, he determined to learn telegraphy.

Here was the beginning of that remarkable career, and of those discoveries which, if they have not revolutionized the telegraph system, have certainly promoted its efficiency and perfected its instruments. While residing at Adrian, Mich., he opened a shop for repairing telegraph instruments and making new machinery.

Mr. Edison's history is more than usually rich in incidents of an interesting character. When he was selling papers and candies on the trains of the Grand Trunk Railway, he was making a hobby of chemistry. At this time he was a mere boy. Not having any other facilities for experimenting, he constructed an amateur laboratory in one corner of a baggage-car. When other boys would have been at play, he was amusing and instructing himself in that corner. During his absence one day a bottle of phosphorus by being upset, or in some way broken, set the car on fire.

Grave doubts were entertained as to the propriety of having so dangerous a lad on board the train, and the baggagemaster kicked his chemicals and apparatus out of the car, which did not, however, put an end to the boy's passion for chemistry. He improvised

another laboratory in a different place, and continued his studies as before.

Naturally a mind so alert was constantly seeking out new inventions. He never saw an instrument without immediately asking himself whether it could not in some way be perfected.

The idea of the telephone had long been in existence. It was first practically applied in the construction of toys. One called the "Lover's String" was made in 1831, and is the simplest form of a telephone. The discoveries and improvements of Mr. Edison have aided greatly in perfecting this instrument. The transmitter, constructed and improved by him and Blake, is combined with the Bell telephone and makes the telephone of general use. To such a state of perfection has the instrument been brought that over long distances, even between some of our great cities, communication can be successfully carried on.

It is not too much to say that Mr. Edison's ideas have entered largely into all the electrical discoveries of recent time. His inventions consist of improvements in the electric light and the telephone. He is also the inventor of the phonograph, the quadruplex and sextuplex transmitter, the microphone and the magaphone, the kinetescope, the mimeograph, the electric light, the electric pen, etc.

PROFESSOR S. F. B. MORSE.

PROFESSOR MORSE was an American inventor and artist, born at Charlestown, Mass., April 27, 1791, and was a son of Rev. Jedediah Morse. He graduated at Yale College, 1810, and went to England, where he studied painting under Benjamin West. He returned home in 1815, and painted portraits at different places. He visited Europe in 1829, and returned in 1832.

During the passage homeward he suggested the idea of an electric telegraph in conversation with his fellow passengers. He constructed the apparatus of a recording electric telegraph, by which he conveyed dispatches through a small distance, in 1835. About the end of 1837 he applied to Congress for aid, without success. He went to England in 1838 to obtain a patent, which was refused. Wheatstone, an Englishman, had invented a different apparatus for the same purpose, about 1837. In the spring of 1843 Congress voted $30,000 to enable him to construct a line between Washington and Baltimore.

His invention was brought into successful operation on that route in 1844, since which it has been rapidly introduced into nearly all countries of the civilized world. The result has been called the greatest triumph which human genius has obtained over space and time. Mr. Morse received gold medals and insignia of honor from several European sovereigns.

The representatives of the principal European powers, assembled in Paris about 1857, presented to him the sum of $80,000 as a recompense for his invention. Morse's system is generally preferred to that invented in England, on account of its great simplicity. Died April 2, 1872.

Professor Morse must be considered one of the world's greatest inventors and benefactors. Although the idea of talking

by lightning had suggested itself to others before his time, they did not know what to do with it. They were like the men in the common language of our time who have an elephant on their hands and are puzzled as to what use shall they make of it. Professor Morse invented the telegraph alphabet which has been in use ever since his time. He made the tele graph a practical thing, and the world has freely accorded to him the glory of this great discovery. The nations of the earth honored him, bedecked him with medals, and history has placed his name high on the scroll of fame.

As much as we hear about wireless telegraphy, many scientific men predict that this marvellous discovery will never entirely supercede telegraphing by wire in the old-fashioned way. When you think of it it certainly is wonderful that in a moment's time a message can be flashed clear around the world. Man has harnessed the forces of nature and is driving them as he would a span of tame horses. There may be further discoveries along this line, but the telegraphing will still be employed to make such discoveries known even to the ends of the earth.

ROBERT FULTON.

ABOUT the time that Whitney invented the cotton-gin, Robert Fulton, a young American painter studying in England, decided to give up art for the sake of becoming a civil engineer. The young men, whose names are often mentioned together as the two greatest of early American inventors, were of exactly the same age, one a New Englander in Georgia, the other a Pennsylvanian in England.

Fulton had been away from home ever since he was twenty-two years old, and had spent a large part of his time in studying art, with Benjamin West, a famous American painter, whose house in London was always a center for young artists from the master's native land. But, after several years of study, Fulton felt sure that his best work would be in engineering rather than art, and he soon proved his ability by making a number of useful inventions that were patented, by jobs of civil engineering, and writing a work on "Canal Navigation," which was then a matter of great interest in Europe. In 1797—that is, when Fulton was thirty-two years old—the American Minister to the Court of France, Mr. Joel Barlow, invited him to go to Paris and live in his family.

Fulton accepted the invitation, and made his home in the French capital for seven years. These were spent in making experiments and inventions, in managing the first panorama ever shown in the brilliant city, and in studying sciences and languages. He was making up for the scant education of boyhood, for Fulton's parents were so poor that he had been put to the jeweler's trade when very young.

His extra time had been given to drawing and painting instead of books, and almost all the money he had earned by selling his portraits and landscapes he used to buy a little farm in Pennsylvania and settle his widowed mother comfortably before he left home.

In Philadelphia he had the friendship

of Franklin, then a venerable old gentleman of about eighty years; in England he had spent much time with some of the great scientific men, and in France his genius and his noble character won friends for him among the best people in the country. His thin, active figure, his fine head and dark eyes were well known among them, too; and among the people who understood him he was always looked up to. He had already received several medals and honors, and, what was worth more, the sympathy and confidence of many persons of influence.

Steam for Propelling Boats.

About this time there was a great deal of interest and many experiments upon the use of steam for propelling boats. A number of efforts had been made, but no real success was gained until Fulton built a small steamboat which was tried on the Seine and worked well, but was slow. Soon after, he and his helper and friend, Chancellor Livingston, came to New York, and ordered of Bolton & Watt, the great English engine builders, an engine with which they began to experiment upon steamboats for use upon American waters.

For many years Fulton had been thinking and writing about this subject, studying up all that had already been discovered about it, and watching every new experiment that was made, and laboring with greatest energy to bring his own ideas to perfection and into practical form, for he felt that such a deed would be of the greatest benefit, not only to Americans, upon our great lakes and rivers, but to the world. Month after month he worked and tried his little side-wheel craft, until finally he was sure beyond a doubt that he had found out the secret of moving a boat by steam.

When everything was ready, an announcement was made in the New York papers that people wishing to go to Albany might take passage in the "Clermont," which would leave the foot of Cortland street, on the Hudson river, Friday morning, August 4, 1807. Everybody read this notice, and was interested and talked about it; but only twelve people took passage, for it was generally agreed that one could scarcely do a more risky thing than trust his life to that great, new-fangled boat with a fire machine inside of it. Many people had never seen a steam engine, and did not know anything about it, and, while a few gave Fulton their aid and encouragement, a great many thought him ridiculous.

Great Public Curiosity.

Still, there was a great deal of curiosity about his experiment, and crowds thronged the wharves, piers and housetops, and almost the whole water front of the city, and much of the river banks through the country, long before the vessel started. All along her route there was the greatest excitement—hats and handkerchiefs were waved and shouts of praise greeted the ears of captain, crew and passengers, for the "Clermont" was a success, steam navigation was a reality, and Robert Fulton was a great man. The voyage from New York to Albany, a distance of a hundred and fifty miles, was made, against wind and tide, in thirty-two hours, and the return trip in thirty. There was a light breeze against

her both ways, so that there was no use for the sails, and the voyage was made wholly by the power of the steam engine.

Regular trips were now made two or three times a week, and in a short time many other boats, built under Fulton's directions, were plying their way back and forth on the American rivers, while he still labored on to make more perfect the machinery of his great invention.

His Success Assured.

His fame and success were now firmly assured, and as long as he lived he was employed by the United States Government upon steamboats, canals and other engineering connected with navigation. The torpedoes, or war instruments for blowing up vessels by exploding under water, which he had invented and showed without success to the governments of Europe, were now improved and accepted by his own nation, and seven years after the "Clermont's" first trip, Congress set aside three hundred and twenty thousand dollars for a steam frigate or ship of war to be built under Fulton's directions.

This was the greatest delight of the noble inventor's life. The work was finished the next year, and the "Fulton" successfully launched. But it was left for the great Swede, John Ericsson, as an adopted son of America, to bring naval warfare to its present high state of perfection.

Hard and steady work, the anxious care and losses of money in lawsuits began to affect Mr. Fulton's health, and he died while yet in the prime of life and in the midst of his great successes.

It has been said that no American mechanic has ever lived who had such good taste and so earnest a public spirit as Fulton. While in France he wrote letters to Carnot to persuade him to adopt the principles of free trade; he urged the people of Philadelphia to buy West's pictures to start an American art gallery, and when this failed he bought two of the best himself, that America might hold some of the work of her first artist; and these with his other art possessions were willed to the Academy of New York.

He encouraged and aided American talent wherever he could, and while carrying on great studies and experiments upon his steamboat and torpedo, he still found time for planning out a cable-cutter, floating docks and many other schemes for the advancement of enterprise in his native country. He had a noble, patient spirit, keeping cheerful through all discouragements and overcoming everything that stood in his way, and he was so modest and quiet with it all, that few of his countrymen knew what a great man he was until they felt the sudden shock of his death.

Mr. Fulton was born in Little Britain, Pennsylvania, in the year 1765. He died in New York, the 24th of February, 1815.

Triumph Over Difficulties.

Fulton is a striking example of the success that finally comes from the steady and persistent pursuit of a great object. He believed in his own inventive power, and nothing could shake him from his faith. The public scoffed, his friends shook their heads, his projects failed many times, he was involved in law suits, and to all this was added poverty, but he had the genius that never gives up.

JAMES WATT.

JAMES WATT, who was born at Greenock, in Scotland, January 19, 1736, had from his birth delicate health; and as he grew up, instead of being subjected to educational restraints, was, for the most part, left at liberty to choose his own occupations and amusements. His father was a mathematical instrument maker, and in his workshop little Watt soon found his toys. By amusing himself with a quadrant he was led to the study of optics and astronomy.

He was found one day stretched upon the hearth, tracing with chalk various lines and angles. "Why do you permit this child," said a friend to Watt's father, "to waste his time so? Why not send him to school?" Mr. Watt replied, "You judge him hastily; before you condemn us, ascertain how he is employed." On examining the boy, then six years of age, it was found that he was engaged in the solution of a problem of Euclid.

Observing the tendency of his son's mind, Mr. Watt placed at his son's disposal a collection of tools, which he soon learned to use. He took two pieces and put together, again and again, all the children's toys he could procure; and he employed himself in making new ones. Subsequently he constructed a little electrical machine, the sparks proceeding from which much amused the play-fellows of the young invalid.

The father, who was sufficiently clear-sighted, entertained high hopes of the growing faculties of his son. More distant or less sagacious relations were not so sanguine. One day Mrs. Muirhead, the aunt of the boy, reproaching him for what she conceived to be listless idleness, desired him to take a book, and occupy himself usefully. "More than an hour has now passed away," said she, "and you have not uttered a single word. Do you know what you have been doing all this time? You have taken off and put on, repeatedly, the lid of the teapot; you have been holding the saucer and the spoons over the steam, and you have been endeavoring to catch the drops of water formed on them by the vapor. Is it not a shame for you to waste your time so?"

Mrs. Muirhead was little aware that this was the first experiment in the career of discovery which was subsequently to immortalize her nephew. She did not see, as many can, in the little boy playing with the teapot, the great engineer preluding to more discoveries which were destined to confer on mankind inestimable benefits. Another relative, Watt's cousin, Mrs. Marian Campbell, describes him watching the steam from a tea-kettle, and by means of a cup and spoon showing the condensation of steam.

Young Watt was now sent to a commercial school, where he acquired a fair share of Latin, and a little Greek; but his chief success lay in mathematics. At the age of nineteen Watt went to London, and there sought a situation, but in vain; he began to despond, when he obtained employment with John Morgan, as mathemetical instrument maker, in Finch-lane, Cornhill; he remained here but a twelvemonth, and then returned to Glasgow, taking with him twenty guineas' worth of additional tools.

Here he opened a shop as "mathematical instrument maker to the University," and drew around him friends and patrons;

among whom were Adam Smith, Dr. Black, and John Robison; the latter said of young Watt, "I saw a workman, and expected no more; but was surprised to find a philosopher as young as myself, and always ready to instruct me."

Began His Experiments.

It was about the year 1762 or 1763 that Watt's attention appears to have been first turned to the principle of the steam engine, when he made several experiments with Papin's digester; and by balancing a piston-rod with a weight at one end and then admitting steam under it he succeeded in obtaining a continuous motion. But it was not until the following year that his inventive and acute faculties were truly practically engaged upon the great object.

About this time the expense of lifting the water from mines, sometimes from depths of seven or nine hundred feet, was great. Drawing off the water alone in some places cost above $50,000 a year; and the time seemed approaching when the mines would cease to be wrought at all, the outlay greatly exceeding the returns. Steam engines had staved off this result for some years before Watt arose, but the quantity of fuel they consumed was immense when compared with the quantity of mineral and water they raised.

With a model of one of Newcomen's engines, belonging to Glasgow College, Watt began his experiments. He soon found that it would not give the amount of work represented by the fuel consumed, and, having closely examined the construction of the machine, he was lead to ask why the steam should do its work in the cylinder and then be condensed there by a jet of cold water. Steam, like air, is an elastic fluid, and will rush into a vacuum communicating with a vessel in which it is contained. Let the cylinder of the engine be filled with steam, establish a communication between it and another vessel kept as free as possible of air and in which a jet of cold water is playing, the steam will then be condensed and the temperature of the cylinder will not be affected.

His Famous Discovery.

This is the great discovery of Watt. His condensing engine keeps its place after more than a century of progress in the arts, and it will most likely do so until steam itself retires to make way for a cheaper if not a more powerful agent. Watt made his experiments with a little tin cistern, which is still preserved. While busy investigating the subject he was once observed by a visitor kicking it beneath the table to prevent questioning. In the progress of the invention one great anomaly struck Watt, for he found that steam of only 47 degrees or 48 degrees was sufficient to make water rise to the boiling heat of 212 degrees of Fahrenheit's thermometer. On mentioning this strange circumstance to Dr. Black, that eminent chemist showed the cause of it, and then developed the properties of latent heat, which he had lately discovered.

Although Watt hit upon the idea of the separate condenser in 1765, and had in two or three days worked out in his mind the leading points of the modern steam engine, yet it was not until the end of 1774 that his first model was brought to work satisfactorily. The machine tools of the present day were not in existence; he could not even obtain a cylinder that was

true in the bore, and bitter was his lament over the decease of his "white-iron man." Again, the financial difficulty was almost as great a difficulty to conquer as the mechanical one.

Engine a Success.

Soon after his discovery of the separate condenser he entered into partnership with Dr. Roebuck, of the Carron Iron Works. A patent was taken out, Watt agreeing to deed to Roebuck two-thirds of all advantages to be derived from the invention. An experimental engine on a large scale was next constructed, the success of which, with the exception of some practical difficulties that presented themselves, was complete.

A few years afterwards Dr. Roebuck became embarrassed, when, in 1773, Matthew Boulton, of the Soho Works, near Birmingham, was induced to take Roebuck's two-thirds share of the patent of 1769 as a bad debt, until which time the practical application of the ingenious labors of Watt can scarcely be said to have commenced. It has been happily said that without Boulton there would have been no Watt.

In the following year an application was made to Parliament for an extension of the patent, and in 1775 an act was passed extending the term, which, according to the original patent, would have expired in 1783, for a period of seventeen years longer. Watt now applied himself vigorously to the perfection of his invention in all its practical details, and the result was the construction, on a large scale, of what is now known as his single-action steam engine.

During the progress of the accessory improvements must be noticed Watt's ingenious parallel motion, of which he used to say, "Though I am not over anxious after fame, yet I am more proud of parallel motion than of any other mechanical invention I ever made." By this he attempted to remedy the irregularity of action caused by the suspension of the power of the engine during the the ascent of the piston-rod; but his idea was divulged by a workman who communicated it to one Wasborough, who at once adopted it and took out a patent for the application of the crank to steam engines.

A New Motion.

To avoid litigation, Watt abandoned his idea of using a crank, and substituted the "sun and planet motion," an arrangement which may be seen in the "Old Bess Engine," now in the South Kensington Museum. This is a venerable relic of the Soho factory, where it commenced work in 1779, being the very first constructed by Watt on the expansion principle. It was the great show engine in the last century, and was at work in that establishment until a few years ago, when it was removed to its present resting place. The completion of the rotative engine, which placed the whole industry of the country at the feet of the firm, should have given Watt unbounded satisfaction; but on the contrary, he discountenanced it.

Boulton, however, with great foresight, ignored Watt's advice in the matter. We are told that the first rotative engine was erected for Mr. Reynolds, at Ketley, in 1782, and was used to drive a corn mill; and the third engine is still working, though in a

modified form, at Whitbread's Brewery, in Chiswell street. To remedy the irregularity of motion produced by the unequal supply of steam from the boiler, Watt invented the throttle-valve, which being placed in the pipe through which the steam is conveyed from the boiler to the cylinder, the opening and partial closing of it, by means of a lever, increased or reduced the supply of steam, according as it was required. To secure the efficiency of the throttle-valve, and to make it self-acting, Watt connected the lever, by means of which its motion was regulated, with an apparatus, founded on the principle of the regulator employed in windmills, to which he gave the name of the governor. This had the effect of enabling the engineer at all times to regulate the monster of motion under his care to the greatest nicety.

Such a degree of security, indeed, has been obtained, that it is said to be by no means uncommon, on the presence of visitors, for the director of an engine at the Cornish mines, where the most powerful engines in the world are employed, to step on the valve of his vast machine and stop it, until, perhaps, if checked one moment longer, it would blow him and all around into ten thousand atoms—a foolish feat, which no one with a proper regard for the lives of others would venture to put into practice.

GEORGE STEPHENSON.

LOCOMOTIVES came into use in 1804, but their machinery was very imperfect. They were much improved in the next twenty years, and a speed of from four to seven miles was attained, with a prospect of greater. High-pressure engines required to be used, but they frightened the ignorant; the very name was alarming.

The difficulty of arranging the parts of a high-pressure engine on a movable carriage, and the apparent impossibility of furnishing enough of steam to make the wheels turn at the rate of twenty or even ten miles an hour, retarded the progress of the locomotive. If a wheel, 4 feet in diameter, turn 110 times a minute, or travel at the rate of 15 miles an hour, each cylinder will take from the boiler 220 fills of steam per minute; and it is not surprising, therefore, that many thoughtful people, whose opinions were entitled to respect, regarded a speed of 15 or even 10 miles an hour as unattainable.

Where learning failed, however, natural genius triumphed. George Stephenson, once a locomotive engineer in the north of England, and afterwards one of the most distinguished engineers of modern times, invented the tubular boiler, and raised the speed of the engine from 7 to 30 miles an hour. A large heating surface is indispensable to generate the heat required; but the space allowed for the whole engine on the carriage is necessarily limited, and Stephenson's ingenuity was exercised in providing the former without unduly increasing the latter.

The flame and heated air leave the fire-box at a very high temperature, and much heat would be wasted if they were allowed to escape immediately into the atmosphere. Stephenson had already made an improvement on locomotives, which enabled him to supplement the

ordinary operation of the furnace by this heated air.

If the steam, instead of being allowed to escape, were made to pass into the smoke-box, and then conveyed to the chimney, it would act as a powerful blast upon the fire. Instead of blowing the fire, it blows the chimney; and more air will, of course, enter the fire if the chimney be cleared more quickly. This, then, was Stephenson's first great improvement, and it enabled him to give effect to another. Putting the chimney at one end of the boiler and the fire-box at the other, he connected the two by a number of metal tubes passing from the back of the furnace to the smoke-box. Hot air escaping through these tubes, heats the water by which they are surrounded, and enables engines to travel at the rate of 20, 60, or even 70 miles an hour.

A Masterly Invention.

The Rocket was constructed on this principle, and with this Stephenson gained the prize, and placed beyond doubt the propriety of using locomotives in preference to horses or stationary engines. The great object was now attained; a speed of ten miles an hour, with ordinary loads, was certain, and 30 miles was not impossible. George Stephenson came eminently at the right time in scientific history, gathering into one magnificent fact all the floating prophesies of possibilities, solving the problem and setting the question of the railway and the locomotive engine at rest forever by his grand and masterly invention.

The Rocket was the product of the locomotive works which Stephenson, with the aid of Mr. Pease, had established some years previously at Newcastle-upon-Tyne. It was the accurate workmanship of this engine, resulting from the trained hands in the Newcastle Locomotive Works, that stood Stephenson in good stead on the day of trial. The Rocket, which is now in the Patent Museum, presents very little difference in outward appearance from the engines of the present day, except in its small size.

Construction of the Engines.

All the rods and working machinery which heretofore, even in the Darlington engines, were carried high in the air over the boiler, were now placed lower down on either side of it near the centre of gravity, the cylinders being placed at an angle of 45°, and acting directly upon the driving-wheels, the spokes and fellies of which, strangely enough, are of wood.

By the great success of the Rocket the key note was struck. Constructors worked each in his own way, at the locomotive, to improve the detail and increase the efficiency; and for many years the practice of builders was moulded into two general classes of engines, with two cylinders placed horizontally inside the smoke-box, under the chimney, and otherwise essentially similar to each other, except in one great feature, the number and disposition of the wheels.

In one class there were six wheels, of which one pair was placed behind the boilers, typified in the engines of the day, made by Mr. Robert Stephenson; in the other class there were but four wheels, placed under the barrel of the boiler, leaving the fire-box overhung, typified in the engines made for

the London and Birmingham railway. Experience has demonstrated the disadvantage of an overhung mass, with a very limited wheel basis in the four-wheeled engine running at high speed; and it became the general practice to apply six wheels to all ordinary locomotive stock.

Speed that Would Now be Laughed At.

Here we must say something of the speed attained on railways. The greatest speed of Trevithick's engine was five miles an hour. The ordinary speed of George Stephenson's Killingworth engine in 1814, was four miles an hour. In 1825, Mr. Nicholas Wood, in his work on railways, took the standard at six miles an hour, drawing forty tons on a level; and so confident was he that he had gauged the power of the locomotive, that he said, "Nothing could do more harm toward the adoption of railways than the promulgation of such nonsense, as that we shall see locomotive engines traveling at the rate of 12, 16, 18 and 20 miles an hour." The promulgator of such nonsense was George Stephenson.

In 1829, it was estimated that at 15 miles an hour the gross load was 9½ tons, and the net load very little; and that, therefore, high speed, if attainable, was practically useless. Before the end of that year, George Stephenson got with the Rocket a speed of 29½ miles per hour, carrying a net load of 9½ tons. In 1831 his engines were able to draw 90 tons on a level at 20 miles an hour. Nor were the engineers themselves alone mistaken in estimating the gigantic strength of the railway.

A writer in a leading journal, the "Quarterly Review," gravely observed: "As to those persons who speculate on the making of railways generally throughout the kingdom, and superseding all the canals, all the wagons, mail and stage coaches, postchaises, and in short every other mode of conveyance by land and by water, we deem them and their visionary schemes unworthy of notice," and in allusion to an opinion expressed on the probability of railway engines running at the rate of 18 miles an hour, then in contemplation between London and Woolwich, the reviewer adds: "We should as soon expect the people of Woolwich to suffer themselves to be fired off upon one of Congreve's ricochet rockets, as trust themselves to the mercy of a machine going at such a rate."

Laying Iron Roads.

In two-and-twenty years afterwards trains running at more than double this speed had become of daily occurence, and nearly quadruple the speed which so alarmed the reviewer had been attained with perfect safety.

The advantages which had resulted from the Liverpool and Manchester Railway suggested the idea of uniting the metropolis with one of the great manufacturing cities; and Mr. Robert Stephenson was engaged to lay out and construct a line for that purpose between Birmingham and London. Few great undertakings ever excited so much controversy as this. The distance to be traversed was a hundred and ten miles. Lofty heights had to be surmounted, rivers to be crossed, deep valleys and ravines to be passed, and almost every

difficulty that can be opposed to engineering skill had to be overcome.

The preliminary proceedings cost the company the enormous sum of $364,340. The railway was completed in 4 years, 4 months; which upon the whole distance of 112½ miles, gives, as the average rate of progress, one mile in every fortnight; the average cost per mile was $250,000, or more than double the estimate. Yet the road was pushed to completion and was a great success.

MOST USEFUL METAL

Great Number of Uses Made of Iron—Process of Refining.

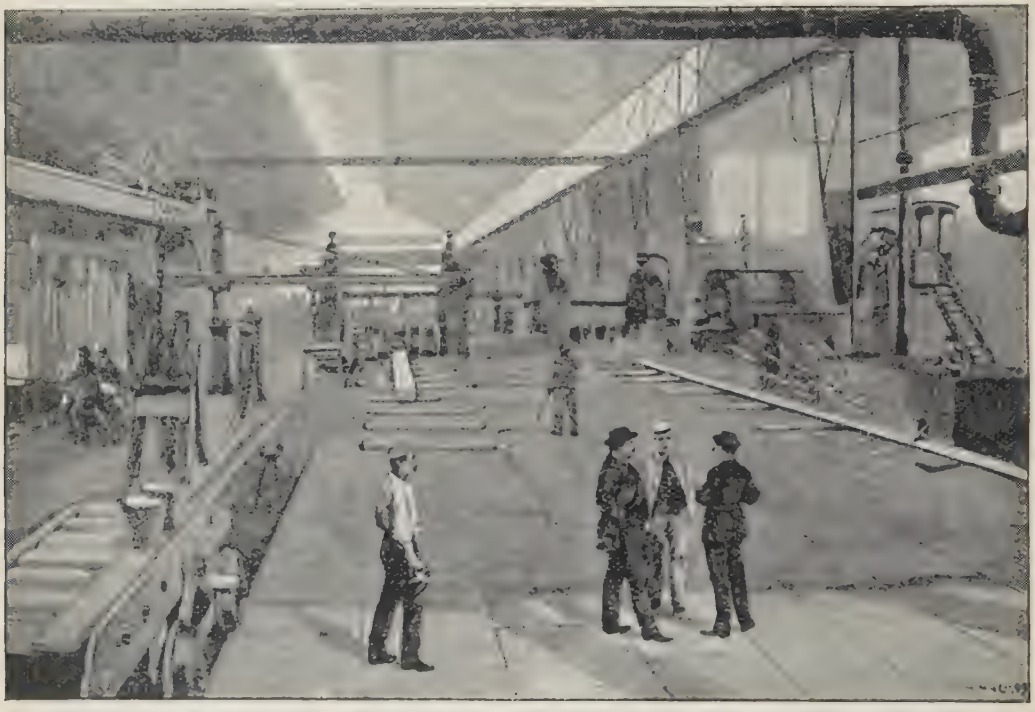
ONE of the important improvements of modern iron making is the use of the hot blast. Very great economy of fuel is thereby effected. A great variety of ovens for heating the blast have been patented. Their essential principle is passing the air through tubes or passages of iron or fireclay that are heated by a flame or hot air surrounding them. The heat is usually obtained by utilizing the waste inflammable gases that formerly blazed away to waste from the top of the blast-furnace.

For this purpose the tunnel-head is cut down or not built, and the charge is thrown on a stopper, which is movable in such wise as to drop the charge with little or no escape of the gases from the interior of the furnace. The most common of these devices is the "cup and cone." The charge is pitched into this inverted cone and rests there until the cup is lowered, when it falls around the cup.

In order to obtain ordinary malleable iron from pig-iron the bulk of the impurities are removed by "puddling" and hammering or squeezing. The old iron-masters simply melted the crude iron in a refining furnace or "finery," and then subjected it to the action of the blast, which sufficiently oxidized the silicon and carbon. Where these are the only impurities that require removal this treatment is still used; but such severe oxidation fails to remove the sulphur and phosphorus. The refining furnace is still used to some extent for the conversion of grey into white cast-iron, or as preliminary to puddling.

One of the most noticeable features in the growth of the manufacture of pig-iron in this country is the development of the blast-furnace industry of the Southern States. In 1880, the South had already commenced to appreciate the value of the extensive deposits of iron ore and coal within her borders, and to realize the superior advantages which she possessed for the cheap production of pig-iron, owing to the close proximity to each other

of these materials, and a number of large coke furnaces were built in that year and the few succeeding years. The greatest activity, however, in undertaking new furnace plants was in 1887, during which year five new furnaces were blown in and twenty-five others were under construction. There has been little abatement in this activity to the present time.



IRON ROLLING MILL.

The greatest activity in the development of the Southern pig-iron industry is seen to have been in Alabama. This State produced in 1890 one-half of all the pig-iron made in the South, and was only exceeded in production in the United States by Pennsylvania and Ohio. Virginia and Tennessee now occupy, respectively, second and third places among the pig-iron producing States of the South.

Prior to this, Tennessee was the second leading manufacturer of pig-iron in that section, but the activity which has been noticeable during the past few years in Virginia in the erection of new furnaces has placed this State next to Alabama among Southern States in the quantity of pig-iron produced.

Probably the industry that requires the greatest amount of capital, employs the largest number of men, and turns out products of the greatest value in the aggregate, is that of iron and steel. There seems to be no limit to the quantity that is needed for a great variety of purposes.

The furnaces never grow cold, and although the work is difficult, there are plenty of men who are glad of the opportunity to undertake it.

VAST SYSTEM OF IRRIGATION

Provision Made by Our Government for Reclaiming Desert Lands to Agriculture—Arid Wastes Turned into Gardens.

THE irrigation bill, passed by Congress, has become a law, and great interest is shown in the work to be undertaken immediately as a result of the passage of the act. This work is to be carried on under the direction of the Secretary of the Interior and will be intrusted to the Geological Survey.

A survey was authorized by Congress to set aside certain tracts of land for reservoirs. This led to a close study of the irrigation question by the officials of the survey, and they are practically prepared to go ahead at once with the work. F. H. Newell, hydrographer of the survey, has charge of the subject. When inquiries were made of him as to the first steps to be taken, he replied:

"The plans have not yet been definitely made, but it is understood that the first steps, after the bill has been taken up by the Secretary of the Interior, will be to complete the surveys of the projects already in hand and to extend the work as rapidly as possible to all the States and Territories mentioned in the bill, in order to ascertain what are the most feasible projects and compare these with each other as regards benefits and cost.

"It is proposed to continue the survey of the St. Mary's project in Northern Montana for diverting water out upon the great plains and reclaiming a large body of public land north of the Missouri river; also to continue the survey of the Gunnison canal, in central Colorado, taking water from Gunnison river for the irrigation of land in the vicinity of Montrose. The general location of this tunnel was determined upon in 1901, and it now remains to complete the plans and estimates and maps of the public lands to be benefited."

It is further proposed to complete the surveys and the examinations of bed-rock for the San Carlos dam in Arizona and to make maps of the lands which have been withdrawn, showing the areas which can be brought under irrigation; also to complete the details for Western Nevada, where grounds are to be irrigated by waters stored in reservoirs situated over the line in California.

"The work of surveying and examination will be carried on as rapidly as possible, but great care will be taken in verifying all plans and estimates before attempting construction. Each item will be submitted to experts whose experience and reputation should serve as a guarantee of completeness when approved.

"The provision in the bill for artesian wells is for the purpose of determining definitely the quantity and quality of water underground throughout the great plains area. Thousands of miles of open prairie land is almost entirely abandoned for lack of a sufficient supply of water for domestic purposes and for watering stock. Geologists who have studied the region have been able to predict the depth of the water-bearing rocks around the margin of the plains and for one hundred miles or so in toward the center, but across the great interior of the plains area little is known of the depth of the water-bearing rocks and of their character, other than that they must exist, since water is transmitted through them from west to east.

Deep Wells Drilled.

"It is proposed to drill a few deep wells penetrating all of the overlying deposits and continuing until the Dakota sandstone or some other well-known water-bearing horizon is struck. A single well on these great plains will determine for hundreds of square miles the fact as to whether there is water in sufficient quantity and in such quality as to justify the construction of wells by individuals or towns.

"Fully one-third of the United States consists of vacant public lands belonging to the people of the country and open to entry and settlement. This vast extent of land is mainly in the West, where from 50 to 90 per cent. of the area of each State belongs to the Federal Government.

"This land cannot be taxed, but on the other hand, must be afforded such police protection as it is necessary for local self-government. The soil is extremely fertile, and where water can be obtained large crops can be had. The vacant land is now used to a considerable extent for grazing sheep and cattle. The country is an open common, across which herds range without opposition.

Reclaiming Waste Lands.

"It will probably always remain valueless to the country unless the general Government provides some means of rescuing it from aridity by storing the large floods and diverting the rivers whose size renders them uncontrolable by private means.

"Individual and corporate enterprise has entered upon the work to the extent of taking up the easily available stores of water. While the small projects have been successful, the large ones have not paid directly, since, under the operations of land laws, a corporation or association cannot control large bodies of land compactly situated. If all the land could be put in the hands of a powerful corporation it could be reclaimed. The reclaimable part could be utilized to advantage, but for years it has been the contention of the Western people that the public lands should not pass into corporate control.

"While it has not paid private enterprise to build large works of reclamation, yet where such works have been built property values as a whole have been increased, although the investors have lost money. In short, the public gains by such reclamation, while the investor loses. It is believed by a study of these works that large enterprises can be

entered upon by the Government, not with the idea of making a profit but ultimately of obtaining a refund of the cost without added interest on the investment.

"Such reclamation work will be slow, but, being widely distributed, will allow of the development of other resources, such as low grade ores and stock raising by use of hay produced by irrigation. By taking up the matter the government should receive back not only its original investment, but also gain through the increases of settlement and of general prosperity due to the utilization of the vacant lands.

Wonderful Development.

"It is not supposed that all of the arid region can be reclaimed, or that the Government will construct all of the works. On the contrary, it is believed that private enterprises will continue to build the smaller works and will find this remunerative where population has increased to a sufficient extent. But out on the vast deserts where no one now lives, it may be many years after government enterprise has undertaken the work that private capital can see a good investment in supplementing the reservoirs.

"The development of the West under irrigation probably will not be any more rapid than the general growth of the country. The products will not compete with those of the East, since they are of an entirely different quality and find a different market. They consist mainly of hay and other forms of forage, of oranges, lemons, grapes, raisins, prunes and other green and dried fruits not produced elsewhere in the United States. The amount of cereals now produced under irrigation in the entire arid region does not equal the quantity raised in the State of New York. Even should this be doubled it could not affect in the slightest degree the grain markets of the country."

Irrigation of Arid Lands.

The Irrigation Act, approved June 17, 1902, commits the federal government to a benevolent supervision of a general irrigation system in the arid and semi-arid sections of the West. It provides that all moneys received from the sale of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming, in excess of the funds already set aside for educational purposes, shall be reserved as a "reclamation fund," to be used, under the direction of the Secretary of the Interior, "in the examination and survey for and the construction and maintenance of irrigation works for the storage, diversion and development of waters for the reclamation of arid and semi-arid lands."

Elaborate arrangements are made for the withdrawal of such reclaimable land from homestead entry, and for its re-allotment on such terms as may return to the fund the cost of the enterprise. When the payments are made for the major portion of the lands irrigated from such works the operation and management of the works are to pass to the owners of the land, but the title to and management of there servoirs are to remain with the Government until otherwise provided by Congress.

Existing water rights of States, terri-

tories and individuals are safeguarded, and it is declared that the right to use the water acquired under the provisions of this act "shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure and the limit of that right." Irrigation on a larger scale in the West is now a fixed fact.

GREAT RAILROAD TUNNELS

Pennsylvania Railroad Trains to Run Under the Hudson and East Rivers and New York City—Superb Engineering.

ONE of the greatest engineering undertakings ever known has been begun by the Pennsylvania Railroad Company at New York, which contemplates the construction of trunk line railroad tunnels beneath the Hudson and East rivers. According to an authorized publication of the plans, the tunnels will commence in New Jersey and run side by side in two eighteen-foot tubes, beneath the Hudson river.

Near the Manhattan shore the two tubes will diverge, following under different streets, and come together again at Ninth avenue where they open into the vast central station. Eastwardly from the station the tracks will be laid in three separate tubes. When the East river is reached the three tunnels will swing northward and converge toward Long Island, and reach the surface.

The work of tunneling beneath the Hudson will be rendered difficult by the great depth of silt and mud on the river bottom, which extends one hundred feet or more before a firm material is reached. This part of the tunnel is to be built on a new principle, designed and patented by Mr. Jacobs, consulting engineer of the Long Island Railroad. It consists practically of a single track bridge enclosed in an eighteen-foot steel tube supported by piers extending down from the truss-work to secure footing on the underlying hard-pan.

The station, which will extend from Ninth avenue to Seventh avenue, will be 1,500 feet in length and 520 feet in width. The platforms alone will aggregate two miles in length. The total area covered by the depot and tracks is equal to four and a half city blocks. Bridges one hundred feet wide will extend over the tracks, the approaches to which will be by an evenly-graded carriageway at each end.

The scheme is the outcome of the acquisition by the Pennsylvania Railroad of the Long Island system and the object is to connect the Long Island Railways with the great Pennsylvania system. With the exception of the New York Central station, there is no trunk line station on Manhattan Island, all other western roads terminating on the west shore of the Hudson river.

The tunnel under the river Thames, in London, has proved the practicability of making excavations beneath a water-bed, and by cemented arches protecting them from being flooded. The vastness of the excavation under the Hudson and East rivers will readily be understood when we state that it will need to be several miles in length, beginning some distance from the river on each side. The width of the tunnel will need to be great in order to render it serviceable for the passage of railway trains.

GREAT TUNNEL UNDER THE HUDSON RIVER.

The advantages of being able to land the loads of freight and passengers in New York, which comes constantly pouring in from the West, without any transfer to ferry boats, are so evident that we may

look for a speedy completion of the undertaking, which will certainly come true if money and mechanical genius are capable of such an achievement.

Close to Herald Square, the Long Island Railroad will build a passenger station for its tunnel to Manhattan The structure will have a frontage of forty-five feet and will extend back for ninety-eight feet nine inches. The proposed station will be separated by a small building, occupied as a real estate office, from the Alpine apartment house. It will be about 170 feet east of Broadway, and accessible by many lines of travel.

Elevators in Station.

Elevators will be provided for conveying the passengers into the tunnel. The remainder of the building will be given up to offices. How large this structure will be has not yet been decided, but as the property in the street is valuable and is increasing in value, it is expected that it will be a skyscraper.

The engineer said that the station would be the Manhattan terminus of the road, and that the plans did not provide for any connection with an underground railroad to Seventh avenue.

The company had in mind the building of a tunnel to Seventh avenue, but its application was denied in the form in which it was made. It is expected that the railroad company will eventually make some connection with the terminus of the Pennsylvania Company's North River bridge by means of a tunnel.

To Be Eighty Feet Deep.

According to the plans of the company's engineers, the East River tunnel will begin in Long Island City, at Thompson avenue and Pulpes street, and follow Van Alst avenue for eleven blocks to Hunter's Point, where it will go beneath the river bed and follow the line of Thirty-third street, Manhattan. The tunnel will be from seventy to eighty feet below the level of the street, and it will dip beneath the rapid transit tunnel in Fourth avenue. On account of the depth below the street level, the building of the tunnel will not be so difficult as the digging of the rapid transit tunnel, for the Long Island Railroad work will be beneath the sewers and water mains.

Rapid Underground Transit.

By means of the East River tunnel, New York will be bound with all of Long Island. It will be easy for passengers to be swiftly transported from Herald Square to homes on Long Island. It is the intention of the engineers to ultimately connect the East River tunnel with the station of the rapid transit tunnel at Thirty-third street, and thus afford an opportunity for passengers to travel from Long Island to Harlem and the Bronx without coming to the surface.

Owing to the fact that the Rapid Transit Commission has several plans under consideration for extending the tunnels, it was decided for the present to grant no permission for tunnels west of Sixth avenue. The Pennsylvania Railroad, which controls the Long Island Railroad, will build a bridge across the Hudson river.

The rapid growth of the metropolis, and, in fact, of all eastern towns and cities, renders new and swift modes of transit imperative. Every problem finds its solution in due time.

STEAM SNOW PLOW

FREQUENTLY when there is a heavy snow-fall, railroad trains are blocked and it is necessary to have gangs of men at work to clear the way for trains. Along the northern part of the United States where snow storms are a regular thing, arrangements are made, around the curves especially, where the snow gathers, for leaving the tracks as clear as possible from obstruction.

When the snow fall is light an ordinary snow plow on the engine is sufficient. However, at large snow drifts a steam plow must be used. The most important part on one of these plows is the immense rotary scoop or shovel which is operated by steam. The snow is thrown high into the air and the sheet iron walls attached to the plow guide the snow to the side of the track; 180 revolutions in a minute does one of these shovels make, which looks like a big paddle wheel.

The steam necessary to operate the plow comes from the locomotive, from which also heated spiral pipes run along the machinery of the plow to melt the snow that might congregate there. At experiments made on one of our railroads the snow was thrown 150 feet in the air. It takes so much steam, however, that a locomotive can run for only about ten minutes, when it is necessary to get up steam again, a process that must soon be repeated.

A ROTARY SNOW PLOW.

A MILLIONAIRE PATRIOT

John Jacob Astor, the Richest Young Man of His Age in America, Faced Bullets in the Spanish-American War and Presented a Battery to His Country.

ONE might fancy the master of many millions of dollars would have been shy of bullets; that he would have had too much to live for to venture where the chances of sudden death were largely in the ascendant. It was a striking object lesson in patriotism, therefore, when John Jacob Astor accepted the appointment of inspector-general of volunteers on General Breckenridge's staff.

Commendable as was the seeking of the appointment, the manner in which he performed his duties on the staff of one of the strictest disciplinarians in the army, was even more praiseworthy. It was not a spectacular post, but one carrying with it no end of hard work, and with little or no chance for glory, as a reward.

This young man, who had lived with a luxury of surroundings only kings may hope to rival, put aside every advantage that his wealth gave him when he entered the army, not to become a lay figure and lounge about headquarters in a spotless, natty uniform, but to be a working head in the great task of organization that went on at Chickamauga. Perhaps it is not too much to say that no one individual of all the thousands who rushed to the defense of their country performed a more useful service or worked with greater thoroughness and finer intelligence than did this millionaire soldier.

His day was from 4 o'clock in the morning till 8 at night. These long hours he spent in the saddle investigating every nook and corner of the field or following General Breckenridge in his tours of inspection through the camp, or in listening to tiresome but necessary reports that dealt fully and voluminously with the condition of the troops and their needs.

It was no great surprise to Colonel Astor's friends that he got a grip on things military in a wonderfully brief space of time, for his inclinations have directed his reading along this line for several years.

Just how well posted he was is shown by his gift of a mountain battery to the government. It is the first mountain battery the United States has ever had, and it was in every way a timely gift. The army needed just such a battery by reason of the character of the work cut out for it in the Philippines.

Colonel Astor's personal interest resulted in the formation of one of the finest organizations of its kind in the world. He saw to the purchase of six 12-pound rapid-firing Hotchkiss guns in England and to the equipment of the men, which experts declared to be well-nigh perfect.

When Colonel Astor went to Cuba it fell to his lot to receive Lieutenant Hobson and the seven heroes of the Merrimac when the exchange of prisoners was effected July 8th. He conducted the squad of our captives to the spot agreed upon for the meeting with the Spanish officer having Hobson and his men in charge and made the transfer.

An Ideal Soldier.

This sums up his "war record." Nothing very striking, on the whole, perhaps, but it was work that someone had to do, and, according to the testimony of his officers, Colonel Astor did it well. In the light of recent developments, it would be interesting to know just how much of an influence his experienee as a soldier has had on the multi-millionaire's ambitions and ideals.

As is the case with many very rich men, Colonel Astor does not know, except approximately, how much he really is worth. He owns about 2600 separate pieces of real estate in New York city alone. The assessment in one year against him was: For personal property, $200,000; for real estate, $300,000. On a valuation of $15,000,000, this would seem to show at once that a large slice of his fortune was untaxed, but it must be borne in mind that he has millions invested in land that is leased, and on which the tenants themselves pay the taxes.

Colonel Astor came back from Cuba to find himself related to the public in a peculiar way. His praise was heard on every hand, while the papers seemed determined that he shall do something striking, not to say sensational, but he is not constructed on any such plan.

Colonel Astor is a graduate of Harvard College. Much of his early life was spent abroad, but he is none the less a good American for that. As a young man he made long trips on foot through Turkey and Greece. He has always had two hobbies, literature and mechanics. His fondness for the former was expressed by a book which he wrote some years ago. It was by no means lacking in cleverness. It was well written and the plot well conceived and carried out. It would have been a creditable bit of work for a professional writer.

Skilful Inventor.

His mechanical skill has found scope in various inventions. One of these is a bicycle brake, while a road-making and cleaning device for which he is responsible was exhibited at the World's Fair in Chicago. He also astonished the natives living in the vicinity of Ferncliff, at Rhinebeck-on-the-Hudson, a few summers ago, when he branched out as a rainmaker on a rather ambitious scale, but was not as successful in this venture as in his others.

President Roosevelt is another example of the high ambition, the ability to work, and the readiness for self-sacrifice often found among the sons of wealthy and well known families. Many instances might be cited of those who have exemplified what is termed the "strenuous life." The advantages of having some noble pursuit are fully recognized.

GIANTS' CAUSEWAY

Natural Wonder on the Irish Coast—Columns of Great Height—Superstitions Connected With the Place.

GIANTS' CAUSEWAY (deriving its name from a legend that it was the commencement of a road to be constructed by the giants across the channel to Scotland) is a sort of natural pier or mole, of columnar basalt, projecting from the northern coast of Antrim, Ireland, into the North Channel. It is a part of an overlying mass of basalt, from 300 to 500 feet in thickness, which covers almost the whole county of Antrim, and the eastern part of Londonderry.

The basalt occurs in several beds, interstratified with layers of whin-dyke. Several of these beds are more or less columnar, but three layers are remarkably so. The first appears at the bold promontory of Fair Head, its columns exceed 200 feet in height. The other two are seen together rising above the sea level at Bengore Head, the lower one forming the Giants' Causeway. It is exposed for 300 yards, and exhibits an unequal pavement, formed of the tops of 40,000 vertical close-fitting polygonal columns, which in shape are chiefly hexagonal, though examples may be found with five, seven, eight or nine sides. There is a single instance of a triangular prism,

The diameter of the pillars varies from 15 to 20 inches. Each pillar is divided into joints of unequal length, the concave hollow at the end of one division fitting exactly into the convex projection of the other. The rock is compact and homogeneous, and is somewhat sonorous when struck with a hammer. The Grand Causeway is itself formed of three causeways—the Little, Middle or Honeycomb, and the Grand Causeway. On the Little Causeway may be seen an octagon, pentagon, hexagon and heptagon all together; on the Middle Causeway is the famous Wishing Chair, with two arms and a back, on a platform where the columns rise to a height of about ten feet.

On the Grand Causeway are pointed out the Lady's Fan, an exact arrangement of five perfect pentagons surrounding a heptagon; the Keystone of the Causeway—a sunk octagon, and the single triangle. At the starting point is the Giants' Loom, an imposing row of columns 30 feet high, each intersected by about 30 joints; to the left is the Giants' Well, to the right the Giants' Chair.

The best way to see the causeway is to

walk along it under the cliffs, and next over them, but he who would see the full grandeur of this wounderful trip of the coast must row along it eastward as far as the Pleaskin. The Pleaskin rises to a height of 400 feet, and is the noblest of all the causeway cliffs. The prospect is unrivaled from Hamilton's Seat, near its top, so named from the Rev. Dr. Hamilton, of Derry, one of the first to discover the causeway in 1786. Beyond it is the Horseshoe Harbor and the group of rocks called the Nurse and Child. After rounding Benbane Head we come in sight of Bengore Head (367 feet high), below which the coast slopes more rapidly southward past the pillars known as the Four Sisters, the Giant's Peep-hole, and the Giant's Granny to the ruins of Dunseverick Castle.

WISHING CHAIR AT GIANTS' CAUSEWAY, IRELAND.

Among the many pleasant superstitions, common to the Irish people, there is one connected with the Giants' Causeway. As it is said that by kissing the famous old stone at Blarney Castle one's lips will become eloquent, so it is said that by sitting in the Wishing Chair at the Giants' Causeway and making a wish will bring to pass whatever one may desire. As this is the tradition, of course, all visitors to this natural wonder sit in this chair and there form their dearest wish.

Very romantic scenery is that which greets the traveler in many parts of Ireland. The northern coast is in many places wild and rugged, not merely in the vicinity of Giants' Causeway, but in other places. Many of the interior parts of the island are very beautiful. This is especially true of the Lakes of Killarney, which are far famed and attract a multitude of visitors. Some part of the beauty of the landscape is due to climate and atmosphere, which furnish the light best suited to render the scene lovely and pleasing to the eye.

MAKING BREAD BY MACHINERY

Old-Fashioned Methods Compared with Modern—Insight Into the Baking Business.

THE earliest and most primitive way of making bread was to soak the grain in water, subject it to pressure, and then dry it by natural or artificial heat. An improvement upon this way was to pound or bray the grain in a mortar or between two flat stones before moistening and heating. A rather more elaborate bruising or grinding of the grain leads to such simple forms of bread as the oat cakes of Scotland, which are prepared by moistening the oatmeal (coarsely ground oats) with water containing some common salt, kneading with the hands upon a baking-board, rolling the mass into a thin sheet, and ultimately heating before a good fire.

In a similar manner the barley meal and pease meal bannocks of Scotland are prepared, and in the East Indies (especially the Punjab and Afghanistan), as well as in Scotland, flour is kneaded with water and rolled into thin sheets, as scones, although this term is usually applied to bread lightened with buttermilk and baking soda. The passover cakes of the Israelites were also prepared in this way. A similar preparation of wheat flour, but where the sheet of dough is made much thicker, forms the dampers of Australia. The Indian corn meal, kneaded with water and fired, affords the corn bread of America. The kinds of bread referred to above are designated unleavened, as no leaven has been added to the dough to excite fermentation.

No chemical change has therefore been produced, except that the starch has been rendered more soluble by the process of baking. Even in the time of Moses, however, leaven was employed in making bread. It is held probable that the Egyptians were the first to use leaven ; that the secret afterwards became known to the Greeks ; and that the Greeks communicated the process to the Romans, who spread the invention far and wide in the northern countries during their campaigns.

Machinery has now superseded manual labor in many of the operations of bread-making. In a few of the largest bakeries the flours obtained from various sources are blended by passing through a sifting machine, and are thence conveyed by a strap or endless screw to large bins. From these bins, when Parisian barn or brewers' yeast is used, the flour is drawn off into barrels or troughs in which the sponge has to be stirred. The stirring is usually performed by means of a vertical spindle provided with horizontal blades, which is made to revolve in a barrel or trough.

At the proper time the sponge is emptied into a kneading machine, the remainder of the water and salt is added and a quantity of flour is drawn off from the bins sufficient to make the mass of the desired consistency. The whole is thoroughly mixed into dough. This operation is completed in from five to ten minutes in batches which will turn out from one hundred to five hundred loaves.

Aerated bread was at one time very popular, but its use is now restricted. The process consists in placing the flour in a strong inclosed iron box, and moistening it with carbonic acid water. The dough is then worked up by machinery for ten minutes or so inside the box, from which it is dropped into moulds, which form into loaves. It is then placed in an oven, when the carbonic acid, previously introduced with the water within the dough, expands, and forms a light palatable bread.

Gluten bread is a bread prepared in such a way that it contains no starch or sugar, so as to be suitable as food for diabetic patients. The flour is made into a stiff dough with water, and allowed to stand for a short time, usually an hour. It is then kneaded under running water so as to separate and wash away the starch. When the wash water ceases to be milky, the remaining gluten is made up into small rolls and baked.

The old-fashioned way of baking both bread and pastry still remains, and our mothers have not improved very much upon the methods of their mothers and grandmothers; but the introduction of machinery into large bakeries has worked almost a revolution in the matter of domestic baking. In fact, everything now is done by machinery, provided only it is possible to invent a machine that will do the work.

BROAD BAND OF PASTRY PASSING BENEATH THE CUTTERS AND APPEARING IN THE FORM OF BISCUIT.

But in the matter of baking no machine can sup ly the place of the housekeeper's skill. Her brain must plan as much as ever. There is no patent method by which the best cooking can be obtained, and there is no cook book that is half so good as an experienced cook. Receipts and rules may furnish some help, but there is no cook book that can tell when the oven is just hot enough, or when the baking is finished or how the pudding is going to taste.

FINGAL'S CAVE

Magnificent Columns and Sea-Floor Flashing With Many-Colored Lights.

STAFFA is a celebrated islet on the west of Scotland. It forms an oval, uneven tableland, rising to 144 feet above the water, 1½ miles in circumference, and 71 acres in area. In the northeast, in the lee of the prevailing winds, is a tract of low shore, stretching out in beaches, and forming a landing place; but elsewhere the coast is girt with cliffs from 84 to 112 feet high. Regarded in section, the rocks show themselves to be of three kinds—conglomerated tufa, forming the basement; columnar basalt, arranged in colonnades, which form the facades, and the walls of the chief caves; and amorphous basalt, overlying the columnar basalt, but pierced here and there by the ends of columns and by angular blocks.

The most remarkable feature of the island is Fingal's or the Great Cave, the entrance of which is formed by columnar ranges on each side, supporting a lofty arch. The entrance is 42 feet wide, and 66 feet high, and the length of the cave is 227 feet.

The floor of this marvelous chamber is the sea, which throws up flashing and many colored lights against the pendent columns, whitened with calcareous stalagmite, that form the roof, and against the pillared walls of the cave. First described by Sir Joseph Banks, after a visit in 1772, Staffa has since been frequently visited—amongst others by Wordsworth, Scott, Mendelssohn, and on 19th August, 1847, Queen Victoria.

The western part of Scotland is hilly and rough, but the feet of the Highlanders have trodden it for so many centuries that its rugged appearance has taken on some of the evidences of civilization. All around the coast of the western and northern parts there are islands which are washed by the waves of the turbulent sea. Although these are inhabited many of them seem to be little principalities by themselves.

Of the 787 islands, belonging mostly to the Hebrides, Orkneys, or Shetland, sixty-two exceed three square miles in area, and of these the largest are Long Island 859 square miles, Skye 643, the Mainland of Shetland 378, Mull 347, Islay 246, Pomona 207, Arran 168, Jura 143, and North Uist 136.

Of twenty-six rivers flowing direct to the sea the chief are the Tweed 97 miles long, Forth 75, Tay 93, Dee 87, Don 82, Deveron 62, Spey 96, Clyde 106, and Nith 71; and of these the Forth, Tay and Clyde expand into important estuaries. There is also the Moray Firth; and indeed the whole coast is so intersected by arms of the sea that few places are more than forty miles inland.

Fresh-water lakes are numerous—Lochs Lomond 27 square miles, Ness 19, Awe 16, Shin, Maree, Tay, Earn, Leven, Katrine.

GREAT POLAR EXPEDITION

Trying to Reach the South Pole—A Realm of Ice, Snow and Volcanic Mountains.

THE Antarctic Ocean is situated about or within the Antarctic Circle. The Great Southern Ocean, according to modern geographies, is that part of the ocean which surrounds the world in one continuous band between the latitude of forty degrees south and the Antarctic Circle. This band is only partially interrupted by the southern prolongation of South America. The northern portions of this band are often called the South Atlantic, South Indian and South Pacific, while the southern portions are usually called the Antarctic Ocean.

The average depth of the continuous ocean which surrounds south polar land is about two miles. It gradually shoals towards Antarctic land, which in some places is met with the short distance within the Antarctic Circle. The ship "Challenger" found 1800 fathoms near the Antarctic Circle, south of Kerguelen, but Ross records a much quicker depth in the same latitude south of the Sandwich group. Only three navigators, Cook, Weddell and Ross, have crossed the 70th parallel south.

Ross discovered Victoria Land, and in February, 1841, sailed along its coasts within sight of the high mountain ranges, 7000 to 10,000 feet above the sea. The mountain range terminated in an active volcano, Mount Erebus, 12,000 feet in height. His farther progress was stopped by an icy barrier 150 to 200 feet in height, along which he sailed to the east for 300 miles. The depth of this ice barrier was 260 fathoms, so that it was just in the condition to generate those large flat-topped tubular icebergs which are the characteristic feature of the Antarctic regions. Where the coast is steep and high there is no true ice barrier, the ice being only six or ten feet above the sea, extending many miles from the shore. The land is of volcanic origin. No vegetation or land animals have been observed on this barren waste but whales, seals, and various kinds of sea birds abound.

The winds blow in towards the Pole from the Southern Ocean, carrying with them much moisture. The ice on the Antarctic Continent is stated by some writers to have a thickness of several miles, but there is no reliable information on this point. All our knowledge of the Antarctic region is confined to the summer months of January, February and the first weeks of March. No person has penetrated these regions at other seasons of the year. In 1840 the United States expedition under Captain Wilkes discovered a long coast line, apparently extending from Enderby Land eastward to

Ringold's Knoll, but the only part of this which has since been found was discovered by Balleny in 1839. The most important results obtained in the Antarctic region was due to Sir James Clarke Ross, who made three voyages in 1839–43, discovering Victoria Land with a lofty range, containing the volcanoes Erebus and Terror. He traced the coast from the highest latitude yet reached in the Antarctic, after passing some ice floes which were 1000 miles broad. These southern expeditions of Ross, like those of all chief polar explorers, have supplied valuable information for students of magnetism, meteorology, geology and natural history, besides extending the bounds of geographical science. The "Challenger" expedition only just crossed the Antarctic Circle.

BORCHGREVINK, THE FOREMOST DISCOVERER IN THE ANTARCTIC CONTINENT.

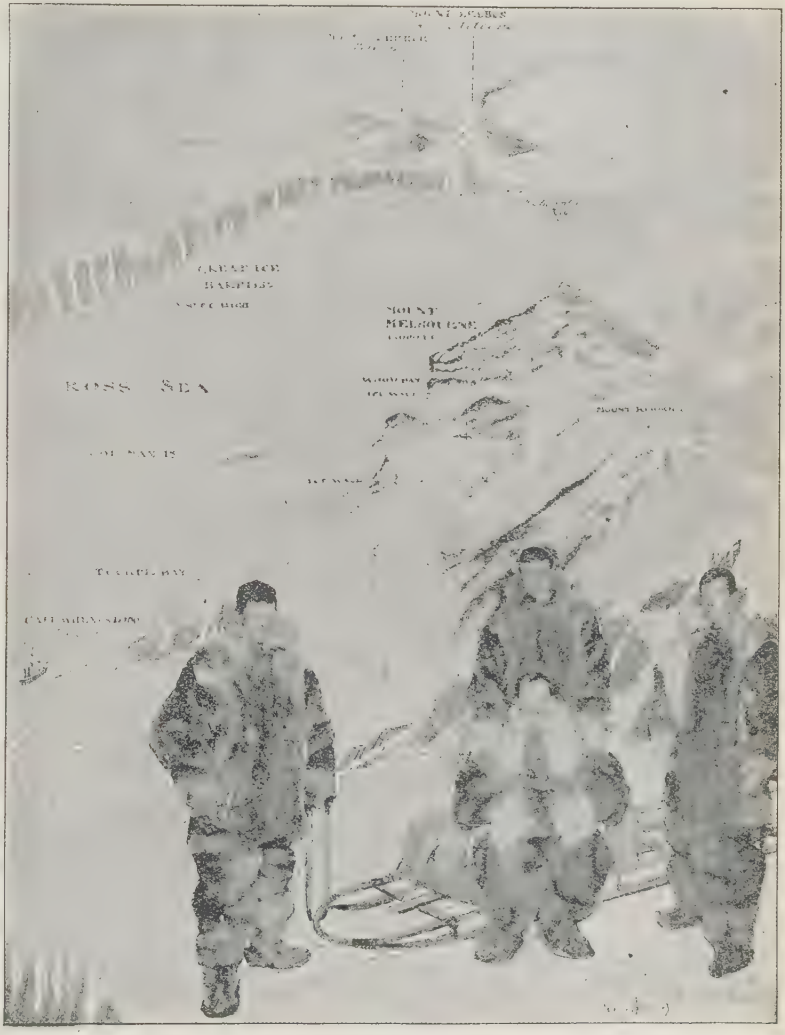
Our illustration represents C. E. Borchgrevink, F. R. G. S., commander of the Antarctic Expedition of 1898–1900 (which was equipped by Sir George Newnes) on his reaching the farthest degree south on record. "Every detail of the picture," says the artist, "from the costume to the ski-sledges and equipment, has been painted from the outfit actually in use at the time. Borchgrevink himself looks out of the picture with worn penetration in his eyes as he surveys the ice-bound landscape, and seems to still say, 'Farther South.' Mr. Borchgrevink told me that

at times it was pathetic in the extreme to see the pleading of the dogs, few of whom were at this point left alive, some having been frozen to death, and others lost or fallen through exhaustion; suffering as keenly as the men, yet these fine animals were courageous to a degree. The leader's favorite dog, Zembla, in front of the picture, looks up at his master with wistful, longing eyes from under his shaggy brows; others wait his bidding on the frozen ground, and one has fallen."

The first flag (the Union Jack) ever hoisted on the Antarctic Continent was presented to the expedition by the Prince of Wales.

Our ideal bird's-eye view of the region around the South Pole shows the main features of Victoria Land, the area in which the expedition began its operations. It lies about 1600 miles due south from New Zealand. It is one of the most promising districts in which to solve the many problems which it is expected will find their solution in the Antarctic.

The four men in the foreground are members of the "Discovery's" crew, and were photographed in their furs before leaving England. They are presumed to be standing on Cape Adare, at the entrance to Ross Sea, which stretches 500 miles inland. Immediately behind them is seen the exposed basalt, of which the cape is formed. This and Cape Wheatstone are almost the only elevations which are completely buried in ice and snow.



EXPEDITION IN SEARCH OF THE SOUTH POLE.

Everywhere else the mountains, however high, are completely enveloped in an unbroken covering of white. Mount Erebus presents the astounding spectacle of hot volcanic action in immediate proximity to an ice barrier, which is in parts literally thousands of feet thick. There are wonders in the Antarctic realm.

BEST ATHLETIC EXERCISES

How to Maintain the Health of the Body—Rules for Home Training. Exercises that Develop Athletes.

HORACE BUTTERWORTH, instructor of Physical Culture at the University of Chicago, an authority on athletics, has this to say about health and the means for promoting it:

The form of gymnastics which is the most agreeable is the one usually adhered to the longest, and, in general, is the one which will produce the best results.

The means of exercise most commonly selected by people of sedentary life embrace arm flingings, trunk bendings and leg raisings without apparatus, the same with resistance from the group of muscles opposite to the group acting, similar work with dumbbells or wands in the hands, and exercises with chest machines (pulley weights and rubber "expanders"). Men and women in health may count with confidence upon agreeable feelings as a certain result of vigorous work of this character, sensibly performed; but the repetition of the same movements daily for several weeks will bring many to a condition of mind somewhat similar to that of the man who ate forty-seven patridges at successive meals.

Punching the bag, boxing, wrestling, fencing, dancing and tumbling, however, scarcely ever become monotonous.

Tumbling is a form of exercise which affords an almost inexhaustible fund of amusement and healthful exertion. It is adapted to the weakness of children, the strength of men, and the airy grace of women. The whole family can participate in the muscle building, nerve stimulating, lung expanding, heart strengthening amusement provided by "Tumbling at Home."

By "tumbling" is meant not merely the exercises which are commonly supposed to be covered by the term, such as flip-flops, somersaults, etc., but all the bodily movements which a broad use of the term would imply. Our earliest days are filled with tumbles galore, and something within us brings a smile to the lips at all times of life when we see a person stumble and fall, even though we may know the bump has been a hard one.

Tumbling, then, is sure to be popular in the home, especially if the father and mother will lay aside their weight of care and dignity and join in the fun.

In addition to their amusing and stimulating characteristics, many of the tumbling movements excel any drug prescription for the quick removal of superfluous avordupois, the correction of digestive disorders and functional irregularities, etc. Some sufferers do not hesitate to take poison as medicine; others will walk barefoot in the dew in a public park despite their threescore dignity of feeling; a few will lie down in bed, make themselves limp, close their eyes and mutter to themselves: "I am getting well; the disease is leaving me; I feel it oozing out; my mind is clear; my feet are warm; my lungs are healed; my heart is strong; I am well." Then why not tumble.

Simple Tumbling Movements.

Tumbling for fun requires no apparatus save enough rugs or a mattress to make your downfall comfortable. When the whole family is present to take note, advise, criticise and share in the sport, proceed as follows:

1. Run quickly to the center of the room spring into the air and click the heels together twice before alighting. The juvenile name for this is, "Rap the donkey's heels."

2. Place the toes of both shoes upon some designated mark on the floor, then kneel. Rise without moving the toes from the mark or touching the hands to the floor, both knees to leave the floor together.

3. Kneel at the edge of the mat, grasp the instep of each foot with the corresponding hand, as shown in cut No. 1. Lean well forward, pull the feet from the floor and run across mat on the knees.

4. Raise the heels, bend the knees as much as possible and place the hands on the mat inside the knees. Throw the legs backward until they are straight and support the weight on the balls of the feet and the hands, as seen in cut No. 2. Travel across the mat by moving the hands. Drag the feet so that the upper parts of the toes are against the floor.

5. Start to travel as in the preceding feat. Lift both hands from the mat and clasp them together, then replace on the mat before the body falls. Do this rapidly three or four times.

6. Start to travel as before. Spring forward from the toes and bring the knees as near as possible to the chest. As the feet are about to touch the mat press strongly from both hands and raise them a trifle; at the same time put the feet through and assume a sitting position with the legs flat on the mat in front of you. After a few trials it will not be necessary to raise the hands.

7. Put yourself into the starting position of the preceding exercise. Raise both hands from the mat and slap the chest. Keep the hands down and raise both feet backward and kick the heels together. Spring from the hands and feet at the same time, and while in the air clap the hands and click the heels. Do this quickly several times. It is a vigorous exercise.

8. Raise the heels. Bend the knees as much as possible and rest the tips of the fingers on the floor. Extend one leg forward until it is straight, and rest the heel of that foot on the floor. With an upward swing of the arms and a jump change the position of the legs—the forward leg is brought back and bent and

the bent leg is put forward. Do this rapidly a dozen times or so.

9. Raise the right foot backward and grasp the right instep with the right hand. Hop forward. Put the right knee on the floor. Rise without touching the floor with the hands, with the right foot, or with the other knee. If any difficulty is experienced it may be overcome by leaning well forward as the attempt is made to rise.

REMARKABLE FEAT OF ACROBATS.

10. Take the toes of the left foot in the right hand. Jump through with the right foot. Lift the right knee high, be confident, and the trick is done. Keep tight hold with the right hand. When this can be done easily jump backward to the starting position.

11. Lie on the back. Raise the legs and support the weight on the back of the head, the shoulders and the elbows. The hands hold the waist, the fingers behind and thumbs in front. The legs should be vertical. Bend knees until they almost touch the face. Kick upward and slightly backward as vigorously as possible. You will be lifted clear of the mat and moved a few inches backward.

12. Stand with the heels about two foot-lengths apart. Bend the knees and place the hands under the knees and as far backward on the mat as possible without losing balance. Support the weight about equally on the hands and feet. Move the right foot and the right hand together backward. Do the same with the left and travel rapidly.

13. Place the hands on the floor about a foot in front of the toes, with the fingers slightly bent and spread. Put the chin against the chest and lean forward until the back of the head rests on the mat. Push strongly with the toes and roll, keeping the knees close to the chest. As the toes leave the mat swing the arms vigorously forward and grasp the legs a little above the instep and pull. This will bring you over on your feet in the squatting position. If there is room for another, take the hands off the shins, put them on the mat, and proceed as before. This is the "forward roll."

14. Backward Roll—Raise the heels and bend the knees as much as possible, keeping the back nearly straight and the arms at the sides. Rest the fingers on the floor to maintain a balance. Throw yourself backward so as to touch the mat in the following order: The heels, the hip, the back, the hands, the shoulders, the head. The hands are swung backward as soon as the roll is begun and are placed down alongside the head. As

soon as they touch the mat, push strongly with them so as to make room for the head to turn. Keep the knees close to the face and you will land in the position from which you started.

15. Backward Roll to Handstand—Start as in the preceding exercise. As the hands touch the mat in the roll the knees will be close to the chest. Kick as vigorously as possible upward and backward and straighten the arms. If the kick is nearly straight up in the air you will come to the handstand position. In your early trials, however, you will go backward to stand on your feet.

16. Dive—Have someone kneel crosswise of the mat. Stand on one side, put your hands down on the opposite side and roll over. Next time lean forward, give a slight jump and alight on the hands and roll. Do not allow the arms to bend suddenly, but gradually, so that you will not come down with a hard bump. You can soon increase the distance considerably and get along without the obstruction. A fine feat is to dive over chairs, after you have become expert.

17. Snap Up—From the squatting position roll backward onto the shoulders, with the hands on the floor alongside the ears, as though about to roll over backward, but with the legs straight and extending backward over the face. Swing the legs vigorously forward and upward. After they have a good start push hard with the shoulders, the head and the hands. When properly combined you will land on your feet in the squatting position, if the feet have not been thrown very high, or standing erect if you have put sufficient impetus into the upward and circular motion of the legs. The legs describe a semi-circle and the back is arched at the beginning of the movement. This is not difficult, but it may be puzzling for a little time to some.

18. Head Stand—Place the hands on the mat the width of the shoulders apart, with the fingers spread and slightly bent. Place the fore part of the head on the mat a foot or more in advance of the hands. Have one foot just a little behind the hands and the other leg nearly straight. Throw first the rear foot, then the other, upward to something like a vertical position. Divide the weight between the head and hands. Bring the feet back to their starting position. After the movement is somewhat familiar, instead of bringing the legs back to the floor, stop them when the knees are near the chest, put the chin against the chest, push forward with the hands and roll over forward to stand on the feet.

HEALTH FOR AMERICAN WOMEN.

DR. ELIZA MOSHER, director of the Woman's Gymnasium, University of Michigan, writes thus to women:

"When we ask what is health of body we receive a variety of answers, the best of which is that of the biologist, who says: 'The body is in health when all its cells and tissues are in a state of normal activity.' What is meant by 'cells' and 'normal activity'? The human body, like the bodies of animals and plants, is made up of 'life stuff' (microscopic particles of protoplasm) called cells. They come into existence through the division of a material cell like themselves; they imbibe nourishment from the liquids which sur-

round them; they undergo chemical changes whereby they add to their substances, or grow, and under the influence of that obscure force which we term vital they become specialized in function and take upon themselves a variety of offices within the body, such as muscular contraction, the formation of protective coverings, the manufacture of secretions, absorption, etc. The life period of some of the cells is short, while that of others (in the nervous system, for instance) is co-existent with that of the body itself. How many cells enter into the structure of the human body? So many that we can find no figures to number them.

GROUP OF TRAINED ATHLETES.

"When the biologist speaks of 'normal activity' he refers to the uniformity with which cells and tissues of the same kind in different individuals perform their functions; the fixed and uniform way in which organs do their work is called normal functional activity. A heart-beat of seventy-two per minute and a temperature of 98.4 Fahrenheit are normal for adults. Under unfavorable influences arising within the body or outside of it cell activity may be modified or totally interrupted. When any considerable number of cells or even a small number of vital importance to the body, are thus interfered with a condition is produced which is termed 'disease.' Death occurs when the body is deprived of the work of these cells upon which its necessary processes depend, or when deprived of the offices of so large a number that the remainder are no longer able to maintain their vitality.

"The chemical changes which body cells continually undergo are accompanied by loss of cell substance, hence the process of cell repair must go on simultaneously or loss of body substance will result. A study of body cells and tissues shows that their two principal constituents are water and protein. In addition, they contain oxygen, fat, starch and inorganic salts. Water, therefore, is a true food and should be used in large amount—one or two quarts daily in addition to that taken with meals is not too much. It is needed not only to replace that which is lost from the cells, but also to float to them nutrient materials liquified in the digestive canal and passed to the tissues. It is also needed to carry out of the body the products of waste. If a surplus of water is taken it easily finds its way out through the kidneys, lungs or skin, thereby all the more effectively performing another function—that of removing waste.

"Protein, the second most important cell-building substance, is derived mainly from lean meat, milk, eggs, cheese, game and legumes (beans and peas). In these food

substances protein is associated with fat, and in some (as in the grains and legumes) with carbonhydrate (starch) in large amount. People who discard animal foods and products depend for their protein upon grains, legumes and tubers. The objection which may be raised to this is that it is uneconomic to use a surplus of one food substance to obtain a sufficiency of another; they are obliged to take too much starch to obtain the needed protein.

Requires Force.

"The body requires not only cell-building material, but energy-producing substances to maintain its heat and produce movement. Within the body, as elsewhere in nature, force is generated by chemical change. Carbonydrates (starch and sugar) and fats when taken into the body readily undergo dissolution; the products of such change are easily gotten rid of, hence the importance of using fat, starch and sugar in sufficient quantity as generators of energy, increasing the amount in cold weather, and when physical exertion is demanded.

"All foods contain enough inorganic salts to replace those lost from the body. Chloride of sodium (common salt) possibly may be an exception, since we crave it in perceptible quantity. It increases the palatability of many foods, and as it is easily removed from the body there is no objection to its use as a condiment. To keep the body in health it is necessary to supply it regularly with water, meat (or its equivalent in protien-bearing food), with fat and with sugar or starch. The proportion of these in the day's food, roughly given, would be three parts protein, one or two parts fat and six parts starch or sugar. The quantity of food required depends on age, sex, activity of mind and body, habit, season, climate, etc. In children not only repair of cells is going on, but also their multiplication, as the process of growth proceeds. They need more food, therefore, in proportion to body weight and size than do adults. None need be troubled by the voracious appetites of growing children. Provide them with well-cooked food (changing the proportion perhaps to two parts protein, one part fat, to eight or nine of starch and sugar, giving at the same time a sufficient amount of vegetable food 'to fill up the chinks'), and they will not injure themselves by over-eating. After the age of fifty years chemical changes within the body go on more slowly than in early life, and less food is needed to replace loss. If a 'green old age' is desired a careful guard must be set upon the appetite, and only as much food consumed as can be utilized by the body.

Eat Too Much.

"Habit has much to do with the demands of appetite. We in America, no doubt, get in the habit of eating more than do our transatlantic neighbors, and especially do we eat more protein food. Some sanitarians attribute to this the nervous disorders grouped under the popular term 'Americanitis.' It is quite possible they are right, but we should include in the explanation the free drinking of ice water with meals, an unstinted use of sweets (candy, for instance) with and without other food, mental strain and worry and an indoor life.

"The liver is a vast colony of cells, which

are surrounded by blood vessels, microscopic in size. These cells undertake half a dozen different kinds of work for the benefit of the body, and therefore when disordered the entire body suffers. To keep them in health much water must be taken, and only such amounts of protien, sugar and starch as are really needed for the body use. Vigorous physical exercise should be habitual, and chilling of the skin should be avoided.

Wonderful Cells.

"Every cell and tissue of the body requires oxygen to maintain its life. How is it possible to transport this precious gas from the atmosphere to the numberless and remote cells within the body structure? Thus far we have considered only those cells which are fixed and stationary within the body. We now turn to cells quite as wonderful which are never for a moment fixed, from the time they are launched upon the blood stream from their birthplace within the narrow cavity of the long bones, until their life-work ends. Down the blood stream they move, now hurrying through large vessels, now floating lazily through those of microscopic size. With but one office for the blood are they intrusted, viz., the carrying of oxygen to cells and tissues. Hungry for this gas, the red blood cells pass through the capillaries surrounding the air-filled sacs within the lungs; from the air which these sacs contain they absorb all the oxygen they can carry, which in uniting with their substance changes its color from dark blue to a brilliant red. On their way they float, to give the glow of health to cheek and lip, and vigor to weary muscle cells. From their loosely-carried load of oxygen they impart whatever amount the cells along their route demand; two or three times a minute, perchance, the red blood cells come back to the lung reservoir, to refill their ruddy boats.

Movable Walls.

"But how is that small cylinder of air within the chest replenished, from which 5,000,000 red blood cells per cubic millimetre of blood are continually abstracting oxygen? The thorax or the chest is provided with movable walls. Muscles, under the influence of a nerve center in the medulla oblongate (hindermost section of the brain, continuous with the spinal chord) contract and relax eighteen times a minute (more or less) from birth to death; with each contraction the chest wall is raised and its floor (the diaphragm) depressed, thus nearly doubling the size of the space within it; as 'nature abhors a vacuum' air rushes in through nose and mouth to fill the enlarged air chambers. Muscular relaxation and rest follow contraction; down drop the chest walls, and upward rises the tired diaphragm; as the space diminishes the air which it contained returns to that larger reservoir, the atmosphere outside the body.

"What will happen if through tight clothing or bad habits of posture the beneficent work of the chest muscles is interferred with? Manifestly red cells in large numbers will pass through crowded and cramped capillaries, lying on undistended air sacs, without being able to take on the precious cargo for which they came. Since fewer red cells must perform the task of transporting oxygen the muscles in-

crease their number of contractions per minute, and the heart hurries the blood to the lungs, especially when through active body movement an increase of oxygen is demanded. The heaving chest, the fast-beating heart, the flush of cheek after climbing a flight or two of stairs, or any other slight muscular exertion tell the story of limited air space produced by corset or waist bands or by habits of posture which interfere with free chest movement. Such interference with body movement is uneconomic. While it may not produce striking consequences immediately, it predisposes to disease by weakening the power of cells to resist the poisons of disease-producing germs; it also impairs the ability of the mother to produce a robust offspring, thus cheating the nation as well as the individual out of the highest possible development.

"What becomes of the carbonic acid gas which forms in the body in large amount as a result of the chemical decomposition of fat, sugar and starch? The same beneficent stream which floats upon its bosom those oxygen-carrying cells absorbs this gas, which, having no further office, is worse than useless, since it interferes with the absorption of oxygen by the fixed cells of the body. Imprisoned within the moving blood current the carbonic acid gas reaches the air-filled chest, where freedom awaits it. Through the delicate wall of the capillary vessels it bubbles, and on into the air sacs, from whence it eventually finds its way through the trachea (windpipe) into the open air outside the body. The great importance of a free and continuous removal of carbonic acid gas from the body, presents another objection to the altogether too common practice of limiting the move ments of the chest by tight or stiff cloth ing and by bad habits of posture.

"Impure air in living room, bed room or class room will produce similar results to those which follow the limitation of chest movement. It predisposes the body to disease. Children and feeble persons are more susceptible to the influence of bad air than are the robust. Women are more quickly affected by it than men, but no one can hope to long escape its evil consequences.

"To maintain the body cells in normal activity—*i. e.*, in health—the respiratory mechanism should be developed instead of weakened, and by good ventilation the blood should be continually supplied with pure air and kept in a normal healthy state."

HOW TO DEVELOP THE MUSCLES.

DIRECTIONS for bodily exercise are here given by Mr. Frederic W. Stone, of the Chicago Athletic Association:

"The movements I describe demand some exercise of will power and intense effort, but the work is done quickly and the resulting exhilaration is abundant compensation.

"First, assume the correct standing position, raise the right forearm to horizontal, and clench the hand, at the same time throwing all the force possible into the forearm and upper arm. The muscles of the entire arm will become tense and will then vibrate very noticeably as long as the effort is continued. Ten seconds will be sufficient. Do not hold the breath while

making the exertion. There is a tendency to do this, but if you will make it a point to continue breathing freely you will be the gainer by the amount of oxygen given the lungs and will be able the more easily to continue the intense vibratory effort.

Exercises for the Arms.

"Having concluded with the right arm, follow the same process with the left. If performed with proper vigor ten seconds' work for each arm will suffice for a time at least.

"Next, from the proper standing position extend both arms to the utmost, straight out to right and left from the shoulders, palms of the hands downward. Throw into the arms all the force you can muster, tensing the muscles of arms and shoulders. Continue ten seconds, breathing freely while making the effort. As in the preceding exercise, there will be incessant vibration of the muscles while the force is being applied. When the time is up relax a moment, then slightly turn the outstretched arms so that instead of the palms of the hands being downward they will be turned half around to the perpendicular, reach outward as before as far as possible, tense the muscles again and continue ten seconds.

"The next movement is more difficult to explain, but I think I can make it clear to you. The difficulty in performing an exercise should not discourage you.

"Stand, with hands grasping the sides just above the hips, arms akimbo. Then with the legs rigid swing the body slightly and rapidly right and left, throwing all the force possible into the rigidity of the legs. Continue ten seconds and breathe as before. If you have difficulty in getting air rapidly enough through the nose breathe through the mouth.

"Next, standing in same position, arms akimbo, legs rigid, swing the body slightly and rapidly forward and backward, again putting all the power possible into the rigidity of the legs. Continue ten seconds and breathe as before. This and the preceding exercise, properly performed, will wonderfully accelerate the circulation and startlingly enliven every vital process of the body.

"For the succeeding movements stand with the toes turned inward at a slight angle, arms akimbo, knees slightly bent. Grasp the sides firmly with the hands; tense the muscles of the legs and turn the body slightly and rapidly with a circular motion, to be continued ten seconds, breathing as before.

Movements for the Lower Limbs.

"Next, stand with left hand resting on the back of a chair or other support, extend the right leg forward a little, begin as with a slight kick and putting all the power you can in the limb, make it vibrate with a rapid, intense motion. Ten seconds of this will bring the blood dancing to the toe in a tingling stream. Repeat with the left foot and leg, with the right hand resting on a support.

"Arms, shoulders, trunk and legs have felt the revivifying force of the exercises given. Two more should be added, for the neck and head.

"Stand, hands gripping sides as before, chest high, chin level, now bringing as much force as you can to the neck, shake the head rapidly with an upward and down vibratory movement. Continue ten seconds and then vary the effort by

swinging the head with similar movement sidewise.

"It will be noticed that if no stop be made for rest, all the above exercises may be taken within the short space of two minutes. If not too fatigued when through repeat the series again after a brief rest. The benefits to digestion and elimination will be marked, and deficient tissues will be rapidly built up or excess tissue rapidly pulled down if these exercises are persistently followed.

"Too much stress cannot be laid upon the value of deep breathing. One should habitually breathe deeply and somewhat slowly and take in addition a few breathing exercises night and morning. Three to five minutes twice a day devoted to proper breathing exercises will produce truly marvelous results. This is understood, however, when we consider the great value of oxygen to the system in its work of cleansing and building. There is also the activity of the great muscles that are involved in deep breathing. The exercise is beneficial to them and likewise has a direct effect upon the vital organs.

Modes of Breathing.

"There are many advocates of chest breathing, diaphragmatic and abdominal breathing. The supporters of each method urge many points in favor of their chosen mode, but I will not attempt to disuss the matter now. Instead we will devote our attention to the manner of breathing, which in my experience, has proved the most valuable and beneficial.

"First, stand well. Have the body erect and balanced lightly well forward, on the balls of the feet. Inhale deeply, steadily and rather slowly (through the nostrils), packing the lungs with air until their capacity is taxed to the utmost. The chest will show a distinct arch, but do not make the mistake of raising your shoulder in filling the lungs. Now, by both mental and physical effort, concentrate or push the breath against an imaginary point located at the base of the breast bone, and, keeping your chest still raised and perfectly quiet, exhale by means of the muscles of the lower abdomen.

How to Inhale.

"This exercise is to be repeated from ten to fifteen times, and then may be varied as follows:

1. Inhale and exhale slowly and evenly. Repeat seven to ten times.
2. Inhale slowly and exhale quickly. Repeat seven to ten times.
3. Inhale quickly and exhale slowly. Repeat seven to ten times.
4. Inhale and exhale quickly. Repeat seven to ten times.
5. Inhale and exhale slowly. Repeat seven to ten times.

"Exercise should be followed by a bath, which will be found most refreshing. The exercise will cause you to perspire, and to take a cold or even cool bath at once would make the wide open pores contract upon a mass of impurity which is being thrown off. Take a quick, warm or tepid bath, using a little soap, or else wipe off well with a soft towel. Then take your cool or cold sponge or shower bath and rejoice in your feeling of new life and vigor.

"Your diet in summer should receive careful and intelligent attention. Doubtless you know in a general way that dur-

ing warm weather meats and all heating foods are to be avoided. There are certain foods which are heat producers. Fats, meats and heavy cereals, such as corn, oats, etc., are to be eaten sparingly, if at all, while healthful salads, fresh vegetables, raw or stewed fruits and the like may be taken with benefit. Acid drinks satisfy thirst, and lemon juice diluted with water, but unsweetened, is grateful and cooling, overcoming that insatiable craving that leads so many to absorb great quantities of ice water, soda, etc.

"Few habits are so pernicious as the one of drinking ice water. The cold fluid taken into the stomach retards digestion and hinders for a time at least various functions of the body. Since active digestion and elimination are so essential to health at all times, and particularly in summer, it will be seen that iced drinks are dangerous.

"Whether your drink be warm or cold, however, do not take it with your food. Drink plenty of good, fresh water at other times, but during a meal and for the period immediately preceding and following same, avoid it. If you desire a cup of tea or coffee at meal time do not drink it until the close of your repast.

"Above all do not hurry yourself when eating. Eat slowly and be sure that all your food is thoroughly masticated. Digestion begins in the mouth. The saliva prepares the food to be acted upon by various other digestive juices, and also has a mild action of its own in changing the starch of foods into sugar.

"Health and strength are of inestimable value. I know you do not underrate them, but very few people realize how simple is the means by which they may be acquired and retained. The term 'right living' expresses to a nicety the meaning I wish to convey, for surely that includes wise and thoughtful care of our bodies. Exercise, bathing and care in eating will make and keep you well, but drugs will not.

UNDERGROUND RAILROADS

Electric Motors Flying and Passengers Travelling Under Great Cities—New York, Boston, London, and Berlin Provided With Underground Transportation.

ONE of the greatest engineering feats of modern times is the subway under New York City. The difficulties and dangers attending this work render it all the more extraordinary. While this immense undertaking was in progress a prominent city journal gave the following account of it:

"The dreadful catastrophe in the subway workings at Forty-second street has

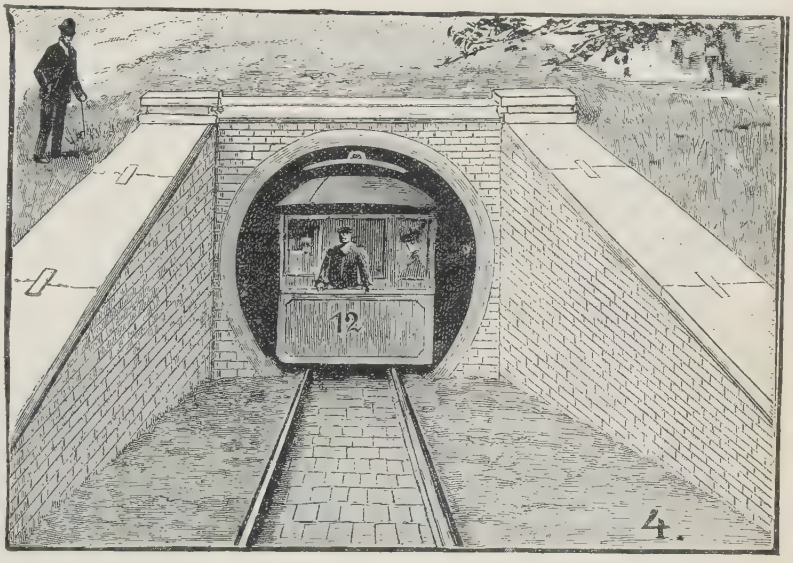
called renewed attention not only to the dangers and difficulties attendant upon one of the most stupendous attempts ever undertaken by a great city, but to the discomforts which New York must undergo in the winning of this new wonder of the modern world. The metropolitan public is looking in a new light at the unsightly holes and heaps which make its streets all but impassable.

"But there is a side to the question which awakens only wonder and admiration. It is as though a city were being laid out beneath a city. At 7 in the morning more than 3000 men go down into the workings, to dig and delve until 6 at night, with a short hour of rest at noon. Even then a majority of them sit around on handcars and barrels, sixty feet below the level of the street, munching at their bread and meat, and washing it down with a thin white Italian wine. Most of these men are Italians, and an overwhelmingly large percentage of them neither speak nor understand English. Their bosses drive them about like animals, and about the only suggestion they have of the home country comes in the musical jabber of their neighbors or in those cans of cheap wine, which the saloons near the openings sell at the price of beer.

"Accidents are almost as common as picks and shovels. Yet the Italians themselves seem to take it all for granted. Stolidly and steadily, with the accompaniment of a great deal of talk, they work on hour by hour, with one ear open for the orders of the boss, and the other listening for the whistle.

"Scarcely a day passes that the engineers in charge of the work do not meet with some problem not anticipated. The scene of their greatest difficulties, however, is not the mile-long tunnel which pierces the stone mountain at Washington Heights, nor the quarry-like cut at Union Square, nor even the undermining of the network of wires and pipes on Broadway or Fourth avenue, but in Forty-second street. According to William Barclay Parsons, the chief engineer of the subway, every problem of underground construction is met with in the four long blocks which lie on that street between Fourth avenue and Broadway.

"In the first place it is solid rock, and



AN UNDERGROUND TRAIN COMING OUT OF TUNNEL.

for nearly a mile not a cubic foot can be removed without blasting. Moreover, at this section the tunnel has its maximum width of four tracks, requiring the excavation of the entire street from the building line on one side to the sidewalk on the other. No other section of the subway is lined so continuously with high buildings, making it necessary that the work at all times go forward with the utmost caution.

Street Traffic.

"The traffic which pours across the street both day and night complicates the work still further. Add to all this the fact that Forty-second street contains as many pipes and conduits as any other street in the world, and the difficulties of construction, even to the lay mind, begin to take shape.

"Another point where constant danger accompanies constant difficulty is at the East River crossing of the tunnel. There between Battery Park and the foot of Joralemon street, Brooklyn, men are at work lashed to stagings, with life preservers hanging near, their floating platforms constantly wrecked by passing river craft and their own lives in peril every moment of the day.

"It is the busiest spot in the busiest harbor in the world. Boats are constantly coming around the nose of the island and from every direction. The tide runs stronger there than at any other place on the two rivers, excepting only at Hell Gate, so that the tug of the harbor police, stationed there to guard the workers as best it may, has to make a constant fight to hold its position.

"Before attempting to tunnel beneath the 4000 feet which there measures the width of the river it was necessary to determine to a nicety the character of the bed. This meant drilling, and it is at this hazardous labor that the men are there employed. In order to steady the diamond drill it was necessary to drive sixty-five foot rigid piles with twenty-foot centers into the bottom of the river, pull the top ends together and chain them solidly to make a pyramid to which the platform might be fastened. In addition to this four 2000-pound anchors are used to help resist the sweep of the tide.

"In spite of all precautions twenty-one wrecks have occurred at this point. One anchor line was cut by a derelict, the staging has been carried away time and again, the pile-driver smashed, the diamond bit lost, and from one to three anchor lines cut repeatedly."

Cost of Subway.

The editor of this volume received the following statement of facts from the Secretary of the Board of Rapid Transit Railroad Commissioners, New York:

"Replying to your favor, I beg leave to say that the contract was let for $36,500,000 to Mr. John B. McDonald on 21st February, 1900; that work was formally begun in front of the City Hall on 24th March, 1900, and that it is anticipated that the road will be in operation and practically finished by Christmas, 1903. It is a four-track structure from the City Hall to One hundred and third street, a distance of say seven miles; at that point two tracks diverge to the east, going as far north as Bronx Park, and the other two proceed directly north to Kingsbridge. The total length of the road is

about twenty miles. It will provide express service practically over its whole length, and to One hundred and third street two tracks will be exclusively for express trains and two for local trains only.

"Electricity will be the motive power by the third-rail system, and the latest and best of everything as to the roadbed and rolling stock and transportation methods will be had.

"The contractor gives ample bond for construction and agrees to operate the road for fifty years, paying the interest on the bonds issued by the city for cost of construction and one per cent. in addition for a sinking fund, which will in less than the term of the contract liquidate the principal. Thus the city will own the road at the expiration of the contract without its having cost anything except the use of its credit. An extension of the system to the borough of Brooklyn under the East River will be constructed to make the means of rapid transit sufficient and complete.

THE BOSTON SUBWAY.

THE Boston subway, which the city built, owns and derives a profit from, and which the citizens like so well that they are extending the system, was regarded upon its completion as one of the greatest engineering achievements of the time.

Authorized by the legislatures of 1893 and 1894, it was begun March 28, 1895, and completed in August, 1898. It was built under the supervision of five men, known as the Boston Rapid Transit Commission.

The legislative act authorizing the building of the subway empowered the treasurer of the city of Boston to issue bonds from time to time as required, to run forty years, and to draw not more than 4 per cent. interest. The first issue of bonds went at 4 per cent., and all the others at 3½, but the premiums paid by bidders actually makes the rate on the entire issue a trifle less than 3½ per cent.

Legislation for the subway was not secured without a fierce struggle. For years the cry for something like rapid transit had been going up from the people of Boston unheard and unheeded. Month by month the conditions became more intolerable, but beyond the adoption of sets of vain resolutions by various bodies nothing was done and nothing was in sight.

The West End Street Railway Company enjoyed a virtual monopoly of street car traffic in the city and all its suburbs, and as it paid nothing for the use of the streets except to keep the paving between its rails in repair it saw no need to do anything. If the people didn't like the service they could walk, and walk thousands did—and saved time doing it.

In 1892 the legislature authorized a company to build an "L" road, but the charter was so hedged about with conditions that no capitalist would put a dollar into it, and it died. The West End people were asked to build an elevated, but they thought they couldn't.

Some one suggested that a good big slice be cut off the Common to widen Tremont street, but the howl of indignation that followed put that plan to sleep. The people rose in their wrath and declared in no uncertain language that not

an inch of Boston Common should be given over to the free use of a private corporation that had for years paid so little heed to the clamor for a better service.

Another suggestion was that a private way wide enough for four tracks be laid out from the north to the south ends, but land takings would have made the cost prohibitive, if the people had not vetoed that scheme. They would not allow a private corporation to make out of every intersecting street a grade-crossing death-trap.

The Subway Adopted.

Then the subway was projected, and met with instant favor. The Rapid Transit Commission was created in 1893. It spent six months examining the subject. Then it asked that it be enlarged to five members, at an annual salary of $5000 each, and that the $2,000,000 authorized expenditure be increased to $7,000,000. The authority asked for was granted almost without opposition.

Careful surveys were made, the whole subway divided into sections and bids advertised for, all the construction work being done by contractors. From March, 1895, to August, 1898, the work of building the subway progressed as rapidly as the plans called for; in fact, some of the sections were finished ahead of time.

The methods of safeguarding passengers are perfect. At no point in the subway is it possible for a person to get upon the track unless by deliberate intention. In two places where it is sometimes desirable for persons to cross from one side of the subway to the other the only means of doing so is to descend a flight of stairs, pass under the tracks, and ascend on the other side. Each station is amply provided with guards and other employes, who direct doubtful people where to go, and render any other needed assistance.

The exits are all provided with a number of turnstiles, the purpose of these being to prevent crowding and possible injury to women and children. Every stairway is ample, and once through the turnstile one may reach the street as quickly as he wishes.

No provision was made in the building of the subway for the carrying of any kind of conduits or pipes within it, except those incidental to itself. This was because, as a matter of fact, the subway offered little inducements to corporations owning such pipes and conduits, the route being already covered in the section of the city where all wires went underground some time before. The city of Boston reserved to itself the right to carry its fire alarm and police wires in the subway.

Cost Less Than Estimated.

Boston built a subway, one of the finest in the world, for about $2,000,000 less than the engineers estimated the cost and fully $10,000,000 less than the opponents of the scheme estimated.

The experience of Boston in the building of this subway proves beyond all question that, backed up by an aroused public opinion, it is perfectly practicable for a city to build and own such works, and that they can be made sources of profit to the city without in any way infringing on "vested rights."

The statement is capable of proof that the net earnings of the street railway

company have increased because of the Tremont street subway, in spite of the heavy rental it pays.

The underground way is clean, well ventilated, without dampness or foulness of any kind and attractive in every way. It does what it was built to do, and the citizens are so well pleased with it that they want more.

George G. Crocker, Chairman of the Transit Commission, says:

"The subway system saves at least four minutes to each passenger. More than 50,000,000 people use it every year. That means a saving of more than 200,000,000 minutes, the full, continuous working time of more than one thousand men.

"The overcrowding of the stations when trolley cars alone were used in the subway was due to the failure of the street car companies to use all the facilities at hand. The subway was carefully planned to meet every requirement for many years to come, and we believe it will do so.

"Undoubtedly the underground system will be greatly extended in Boston, and the will of the people undoubtedly is that the city shall do the work, own it and reap the profit, making it tributary to the city treasury."

LONDON'S UNDERGROUND ELECTRIC RAILWAY.

WHETHER it will ever be possible for an inhabitant of the city of London to breakfast in his underground flat, proceed by underground train to his underground office, and return to sleep in his underground bed after attending a subterranean theatre, only the trained imagination can foretell with any certainty. The possibility of spending one's entire day at some 80 to 100 feet below the surface of the ground is not so impossible as it at first might seem.

Restaurants in brilliantly-illuminated and bemirrored cellars London has long had, and there is now the inauguration of a system of underground communication which may have many weird results. The increase of public subways will lead to the practice of having doors to connect one's basement with these subways, and thus gradually the strangeness of this underground life would wear off.

The most interesting spot to select for obtaining an idea of the subway system is the Mansion House and the Royal Exchange, where the congestion of traffic has made public subways a necessity. On the surface the scene is a very different one from what it was a hundred years ago, when lumbering coaches and wagons rumbled over the cobbled streets. Beneath the surface the change is very much more strange, and the bare idea of any such subterranean tunneling would in the year of grace 1800 have been scouted as impossible, if not impious.

Three great causes have brought these electrical railways into existence—the pressing need for more rapid transit, the invention of the Greathead shield, and the improvement in electrical locomotion. The congestion of activity on our streets, which makes railway communication so desirable, renders their construction by any ordinary means almost impossible, owing to the loss and inconvenience entailed. The solution at present being carried out makes no interference with existing traffic. Tunneling through London clay has been rendered a compara-

tively easy matter by the late Mr. Greathead's invention. In the case of the Central London Railway a circular steel shield, seven feet in length, was employed. Steel chisel-shaped teeth form a continuous cutting edge on the foremost end of the shield, which is forced forward about ten inches into the clay by hydraulic rams. The clay is cleared away, and before the shield is again advanced a section of the cast-iron tunnel is built up inside the rear portion of the shield. It is from the flanged edge of this new section that the rams force the shield forward again.

As the shield is thus slightly larger than the tunneling a space is left all round the tube. This is subsequently filled up with cement, which is forced into position by holes in the plates. The electric locomotive picks up the current which actuates its motors from a third rail running in the centre of the track.

Great Carrying Capacity.

The carrying capacity of these electric railways is great, but even they do not fill the needs of the ever-growing metropolis. Not the least striking feature is the manner in which the traffic has increased out of all proportion with the population, and the increase in the latter is no slight factor. There is no lack of passengers in these cast-iron tunnels.

Both Paris and Berlin, as well as a number of other cities, have adopted the plan of underground railroads.

Travel in the streets of Berlin has increased to such an enormous extent in recent years that steps have been taken to build an underground railway to relieve the congestion. In 1891 plans were made for an underground railway system which was to run north to south. Rapid transit has been on the streets running east to west, but owing to restrictions placed on speed in the city limits the roads became inadequate to carry passengers to the suburbs in convenient time, and greater facilities became necessary.

Difficulties Overcome.

In Berlin the ground is very marshy, and great difficulties were to be overcome in successfully carrying out the plans of the tunnel. However, it has been done. The tunnel commences at Treptow and runs beneath the river Spree to the Stralauer bank. It is 1400 feet long, 750 feet being under the river. The bottom of the tunnel is 32 feet under the bed of the stream, and the tunnel itself is about 15 feet in diameter.

The bed of the Spree consists of diluvial sand, and to do the work compressed air was used. The entire tunnel is a huge iron ring-like pipe, which is clothed in a cement coat on the out and inside. It was built with huge iron tubes telescopically overlapping each other. When one tube had been put in place the next one, which was to overlap the former, was forced into position by the compressed air. Telephone and telegraphic connections were made in the tunnel to the various stations along the route of construction.

The building of this tunnel was, from its very beginning, finished according to the originally-made plans of construction and not an accident was recorded, which is rather unusual on work of that kind. Encouraged by the success of this undertaking, plans have been made for another subway.

ELEVATED RAILROADS

Great Arteries for Passenger Traffic—How they Solve the Problem of Transportation in Crowded Cities.

OWING to the increasing difficulties attendant upon intramural transportation, the elevated railroad has, during the last few years, come largely into favor in populous cities. The problem of how best to transport vast numbers of passengers within a very limited space of time was one of which a solution was most desirable.

In London it was disposed of by the construction of an underground railway, the chalk formation and consequent excellent drainage rendering the driving of a vast system of tunnels entirely feasible. In Paris the difficulty was met by the building of a circular railroad, operated by steam power and embracing a sufficiently comprehensive territory to materially relieve the congested district. An elevated road was erected in Berlin which was operated by cable. This system was, however, found to be cumbrous and impracticable.

As a tentative experiment, however, it had its uses, for capitalists who had hitherto been reluctant to invest in this class of property, seemed to see in the Berlin road possibilities for lucrative returns, and the system has since been expanded by the substitution of a splendidly equipped elevated road operated by electricity.

While the intramural termini of the railroads running into London are practically reached by tracks elevated above the streets, these tracks are merely extensions of main lines and can not be correctly styled city elevated railroads. The beds of these roads are built, for the most part, on long lines of brick arches of the most substantial character, the space between the spans being devoted to warehouse purposes.

Apart from a single line of elevated road which is used in Liverpool to carry freight from the docks, we must look to the United States as the home of the modern elevated railroad; and of the great cities of the Union which have adopted it New York is undoubtedly at the head. In 1875 an experimental line was projected from Fourteenth street to Cortlandt street on Greenwich street. It was finished in the summer of that year and a train of cars loaded with brick and stone was run over the structure.

Nearly the entire length of the line had been traversed when the rails spread, allowing the cars and engine to fall to the street below. The stockholders of the company were so greatly discouraged by this mishap that it was not until the following year the road was opened for business. This road was regarded as insubstantial and unsafe by the general public and not largely availed of until it was remodeled and strengthened.

Dr. Gilbert the inventor of a greatly improved system was the next to attempt to revolutionize urban travel, and a few

years later the Gilbert Elevated Railway Company was formed, which erected a permanent way from the Battery along Church street and Sixth avenue to Central Park. After much litigation the original proprietors sold out to the Metropolitan Railroad Company

The Third avenue and the Second avenue were built later. Chicago has also adopted this system and there have been constructed within the city limits two roads, the Lake Street Elevated and the South Side Alley Road. Another alley road has been built for the west side,

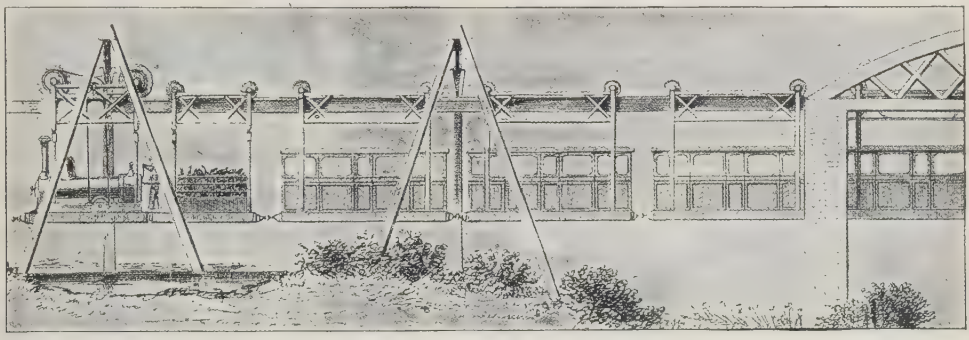
THE BOWERY, LOOKING NORTH FROM GRAND STREET, NEW YORK CITY, SHOWING THE ELEVATED RAILROAD.

which runs nearly on the line of Van Buren street, and extends some miles westward.

The general character of all these structures is the same, and consists of a system of angle irons strongly bolted and running either transversely, horizontally or longitudinally. It is predicted that elevated roads will ultimately entirely supersede other methods of rapid transit in great cities, though the underground system is likely to be a strong competitor.

Another elevated railway system takes its name from the inventor, Mr. Collett, of Cardiff, who designed an overhead railway different from anything that had been projected before.

The accompanying illustration shows what the system is.



COLLETT'S SYSTEM OF ELEVATED RAILWAYS.

The cars, including the locomotive, are suspended as seen in the design. Great hopes of this sytem have been entertained by some engineers, while others regard it as inferior to the New York elevated road, and such it undoubtedly is. It has not yet come into general use.

FIRE FIGHTERS

Millions of Dollars' Worth of Property Saved Every Year by Heroic Firemen—Newest Inventions for Saving Life.

THE tramping of heavily shod feet is heard in the near distance mingling with the harsh beating on the air of the big swinging bells, everybody stands expectant or rushes out of harm's way, cabs and wagons scramble as quickly as they can to the curb, street cars stop suddenly before they come to the crossing, or rush precipitately over it—and in a few moments the gleaming engine dashes madly around the corner with sparks flying and puffs of smoke bursting from the funnel.

There is a building on fire! Here is where every class of citizen feels a common bond of sympathy and where all find a

spectacle at which each can gaze with equal interest.

But see, first, how magnificently the drivers of the engine and of the truck make their turn. The long shaft of the latter looks as if it would mow down everything within a radius of three yards, but no accident of the kind happens.

EXHIBITION OF A CHEMICAL FIRE ENGINE AT A FIREMEN'S REVIEW.

With almost incredible dexterity the handler of the reins directs the animals, holding them in check sufficiently to prevent a collision, yet not enough to lose any time by slowing down.

A catastrophe thus averted, on again go the engine and the truck, and soon they are at the scene of the fire. To establish the fire lines and to have the adjacent police see that they remain

established are but the work of a few minutes, and into the burning building dash the experienced fire fighters.

And yet, in spite of the vivid picture called up in the mind of the actions of the men by any kind of description, no matter how feeble, it should be kept in mind that there is nothing of the theatrical whatsoever in the scene—at least, there very seldom is. The average fireman is an unsoulful person, hard as a rock physically but mentally alert, knowing only his duty and willing at any moment to risk his life in the performance of it.

There is probably no more interesting exhibit in any city than the fire alarm room at headquarters, usually known as

"the platform." This is termed the "nerve system" of the department, because it is unquestionably the most noted part. All alarms of fire are received here and are transmitted by the operators over the circuits connecting the companies that respond to the alarm. In fifteen seconds after the alarm is received, the fire companies are on their way to the fire.

Can Be No False Alarm.

The system is now so perfect that it is impossible for a false alarm to go out from it, or any operator to make a mistake. The operator in charge cannot only tell at a glance what companies have gone out in response to the alarm, but also knows the exact second they leave their respective quarters. He knows, too, when they return. He can tell the very instant anyone touches a wire, no matter in what part of the city. In such case, linemen and groundmen are immediately sent to make repairs, men for this purpose being on duty continuously for any emergency.

The pneumatic fire ladder is a German invention, and it took first prize at the Paris Exposition. It was there that a citizen of Pittsburg saw it in operation, and he decided to have the first ladder made this side of the Atlantic. Pittsburg firemen only took a few lessons to learn to operate it. The construction is simple and easily understood.

The whole truck is built of steel. The wheels have heavy solid rubber tires, and therein lies the electric insulation, as it does not touch the ground. On the truck is a heavy steel tank, which is filled with compressed air of 200 pounds pressure. The tank is supplied at the truck house, as there is no way of filling the air tank in the street at a fire.

On the top of the air tank the ladders are attached to hollow tubes. These are swung into any position on pivots and slides, and can be changed from a horizontal position to a perpendicular or to any angle in a few seconds by the use of air pressure.

The hollow tubes are four in number, and fit into each other. The surface of each tube is polished, and fits like a piston rod in an engine. The first or base tube is not polished outside, but is painted, as it does not slide up and down. It is stationary after having been raised to the required position. The ladders are fastened to the tubes, and the whole rests in a parallel line with the truck.

How the Ladders are Raised.

To raise the ladders a small piston in front of the air tank is filled with air, and the piston from the cylinder is shoved out. This in turn is connected to the tubes with a slide similar to the slides of an engine. As the piston is forced out from the air cylinder the ladders are raised to any desired angle and held in that position by the pressure of air in the air cylinder. To lower the tubes the air is allowed to escape gradually. A chain on the end of the ladders is also used to assist in the raising.

When the tubes are placed in a vertical position, which takes about nine or ten seconds, a man mounts to the first tier of tubes, on which is a small steel platform. Standing on this he has three valves at hand. By opening the first of these he admits the air to the third tube, and it is raised to twenty feet or less, the air hold

ing it in position. The second valve permits the raising of the second tube, and the third valve the first tube. The tubes must be raised from the bottom and lowered from the top. The ladders are so fastened to the tubes that they do not interfere.

A fireman is usually placed on the top round of the ladder before it is shot into the air. He fastens himself to the round with a waist-belt and snap. A line of hose for water or acid can be hoisted in the same manner to any height. If the fire and smoke are issuing from a window in such volume that a fireman cannot approach the windows the ladders can be sustained in an upright position and water thrown into the building from the middle of the street.

If the fireman desires to enter the building through an upper story window the ladders are inclined toward the building. The fireman can thus rescue a person from a window, the ladders can be lowered to within twenty feet of the ground and again raised for another rescue within ten or twelve seconds.

The ladder will hold as many men as can be placed on the rungs, there being no limit to its strength, as the tubes are of very heavy steel. As shafts for ocean steamers are made hollow for increased strength, so the steel tubes are strengthened by the same method. German fire departments have ladders of this make which can be raised 150 feet high.

NEW FIREMEN'S DRESS, EXHIBITED AT ALTOONA, PA.

The limit to the Pittsburg apparatus is eighty-three feet. The firemen who have been raised in the air to this height say that the ladders are more steady than the extension ladders, although there might be some swing to the tubes when a pressure of water is forced through a hose.

Only four men are required to operate the truck. The Pittsburg department has a company of nine men. This leaves one or more off duty. One man operates the levers to manipulate the air from below, another watches the small cylinder to incline the ladders toward a building or to lower the whole to the supporting saddle over the driver's seat. A third man is stationed at the top of the first tube to raise and lower the other three tubes, while the fourth is placed on the ladder and raised into the air.

The new firemen's dress is an invention to protect our firemen when on duty. To the smoke cap air is conveyed by a tube connected with an air pump, and, as a further protection, a jet of water is led from the hose to the crown of the helmet, whence it is spread like a veil over and around the firemen.

The instinctive desire to be present at a big fire is common to most of us, but it is more strongly implanted in some persons than in others. A large number, in the aggregate, endeavor to "assist" at a fire at every conceivable opportunity, and will get out of bed in the middle of the night or leave the most pressing business to do so, whenever possible. Firemen have a peculiar name for these people. They call them "buffs." The origin of the word is lost in mystery, although we have been told it started in Buffalo, and hence the name. This is not a clarifying explanation, but it is the only one available.

UNDERGROUND EYELESS WORLD

Blind Creatures of Cave and Stream—Burrowing Sightless Fish—Eyeless Insects—Curious and Wonderful Living Forms.

WITHOUT light there could have been no life. Supposing animals could have originated and multiplied on some dark planet, it is safe to say that on our own globe, were it not for the stimulus of sunlight, all animals would be eyeless. Yet there is an underground world, a region of perpetual darkness, in which an assemblage of blind or eyeless creatures have lived for ages.

This subterranean fauna is small indeed when compared with the multitude of animal forms flourishing in the upper world of life; but when we consider the very unfavorable conditions of existence in our caves, grottos and subterranean streams, the two most pressing drawbacks being the absence of light and the lack of food, the assemblage is one not entirely to be ignored.

Besides this, in considering the origin of this blind fauna, we are brought face to face with the action of the primary factors of organic evolution. Darwin candidly admitted that natural selection did not account for the origin of cave animals. But half a century before his "Origin of Species" appeared, Lamarch had struck

the keynote, had offered the solution of the problem by his simple theory of disuse, owing to the absence of light.

Wonders of Caves.

Our American cave regions mainly lie in Kentucky, Indiana and Virginia. Mammoth Cave is the largest of about 500 caves in Edmonson county, Kentucky. The limestone plateau, about 8000 square miles in extent, is here so honeycombed that the drainage is almost entirely subterranean. There are in this cave 223 avenues, the united length of which is about 150 miles. The air is dry, and the mean temperature in summer 54 degrees, and in winter 53 degrees.

The same conditions prevail in Wyandotte Cave, in southern Indiana; in Weyle's Cave in Virginia, and in Nickajack Cave in eastern Tennessee. In Europe, the famous Adlesburg Cave, near Trieste, shelters a blind assemblage of insects and allied forms, while in the Pyrenees, on the French side, are many caverns. Indeed, within the past ten years a new underground world has been revealed by French explorers.

They have formed a society whose members in southern France, in the Cevennes, in the region drained by the Tarn, and in the Pyrenees have discovered in all some 300 caverns. As in this country, these caves have been excavated in horizontal limestone strata by subterranean streams, so that the avenues or galleries are mostly horizontal, like the flats in an apartment house, and connected by wells, or deep pits.

The animal life of these caves is represented mostly by insects, spiders and mites, crayfish and other crustaceans, myriopods or "thousand legs," with infusorians, a few snails, blind fishes and salamanders, including the blind triton, or protens, of Adelsberg Cave.

Insects without Eyes.

The insects are mostly beetles of the ground beetle family, and they are far more numerous in the caves of France than in those of this country. These beetles belong to the genus Anopthalmus, which means without eyes, are totally eyeless, with no trace of them on the outside of the head. Another kind of beetle, but much smaller, is Adelops, which is blind, but possesses rudiments of the outer eye, several of the lenses having survived. There is but one species in our country, and that is confined to Mammoth Cave, but in those of France there are nearly seventy blind species of a closely allied genus.

Now, there are out of door forms closely allied, which live under stones, vegetable detritus, or near the sink holes or entrances of caves, and it is apparent that the cave forms are emigrants from the world above, and that the individuals showing a tendency to loss of eyes and varying in other parts after taking up their abode, whether by force or choice, have by isolation from the light and close inter-breeding and increased adaptation to total darkness become first varieties and then fixed species.

And so with the ground beetle referred to. These completely eyeless kinds are comparatively scarce in Mammoth and other American caves, there being only eight species known, but in Central Europe between sixty and seventy species have been discovered. They are evidently

descendants of an eyed genus (Trechus), and there are all grades between those with eyes and those which are completely eyeless.

Now, on dissecting the blind beetle and comparing it with our out-of-door eyed form, we found that in the former every trace of the eyes, as well as the optic nerves and optic lobes, had been effaced. So in Adelope, while there are traces left of the outer eye, the optic lobes and nerves are entirely wanting. So it is with the little eyeless myriopod, or galley worm, of the Mammoth Cave; it presents no traces of the outer eye or of the optic nerves or lobes.

But in the kind common in Wyandotte Cave, eye specks are readily seen, but the optic nerves and ganglia are entirely lacking; these specks are of different sizes in different individuals, showing that this form has only recently become adapted to a cave life.

It is also interesting to know that we never find any rudiments left of the optic nerves and lobes, though the eyes themselves may exist in different stages of degeneration. If the nerves and nerve centres are wanting at all, they are totally abolished. The atrophy is comparatively rapid, sudden and wholesale.

Origin of the Fauna.

The varying degrees of development in the outer eyes, the pigment, or retina, and the lenses in different kinds, prove that the animals entered the caves at different periods, and have been exposed for different lengths of time to total darkness.

These imperfect lenses and retina, like all vestigial structures throughout the animal world, are like ancient, decayed sign-posts, pointing out some nearly obliterated path now unworn and disused.

Thus, in the differing conditions of the eyes in this or that individual we have an epitome of the developmental history of the species they represent. The first step in the loss of eyes is a decrease in the number of facets and their corresponding lense and retina. After a few generations, the facets become reduced to only four or five. The eye is then useless, sight has nearly all gone; then all at once, perhaps, after only a few generations, as a result of continual disuse, there is a failure in forming images, and those complicated, elaborate structures, the optic ganglia and optic nerves, suddenly break down, and are absorbed, though vestiges of the external eye remain.

All From Disuse.

The result of change of environment, with disuse and atrophy of the organs of vision, together with the inheritance of these defects and their establishment as fixed specific and even generic characters, results in the creation of a new natural genus, with its various species, and if we include all the cave animals thus resulting, the creation of a new fauna.

That this is not mere theory is the discovery of good, if not complete, evidence that the abundant myriopod of Wyandotte and Castor caves has directly descended from a common and widely distributed out-of-door form.

All cave animals are colorless or bleached, with the loss of eyesight and of the nervous stimulus of light, the coloring matter as pigment of the skin becomes lost. This is observed in many other

animals which live in partial or total darkness. And this, with their attenuated, lean bodies and limbs, adds to their weird, ghostly appearance.

Sense of Touch Becomes Acute.

In nearly every cave where the eyes are atrophied the tactile sense is enhanced, and the body becomes slenderer and the limbs much longer.

To compensate for the loss of eyesight, the sense of touch is exalted. The antennæ and legs are sometimes of immense length, serving as so many feelers. Besides this long tactile hairs often radiate from the body. Deprived of eyes, cave animals in general are much more wary and guarded in their movements than their allies which enjoy good eyesight. It is interesting when one is on their knees or lying prostrate on the floor of a cave to see how the blind beetles act. In fact, they creep or run about very much like their eyed allies above, and this is due to their enhanced tactile sense.

Another sense which is developed to make up for the loss of eyesight is that of smell. It has been found that the olfactory rods of certain blind crustacæ, including the crayfish, are longer and better developed than in those provided with eyes.

On the other hand, we have found that in the blind crayfish the sense of hearing must be much dulled. The auditory sacs or ears of the blind crayfish are about a third smaller, while the auditory hairs in these sacs are greatly reduced in size. Hence we infer that the ears of the blind crayfish are degenerate, and that the sense of hearing is greatly blunted if not lost.

In other forms, as the blind fish, certain sense-papillæ are developed on the end of the upper jaw ; in the nearly blind spalax of western Asia certain hairs around the mouth are endowed with a delicate sense of touch. In insects, mites and other forms tactile hairs have arisen to make up for the loss of sight.

The eyes are normal in embryos and larger in the young than in the adult. The eyes of blind crayfish are well known to be larger in the young than in the adult. It has been found that the embryo of shrimp living in the Adelsberg cave are provided in the egg with eyes.

The blind shrimp, which lives in deep holes on our shores, and whose eyes are without pigment and smaller in proportion to the body than those of the blind crayfish, has young which before hatching have black pigmented eyes, which can be seen through the egg shell.

Burrowing Blind Fish.

In a burrowing, sightless fish on the California coast, the embryo has eyes differing, says Eigenmann, "in no way from the eyes of other fish embryos." The protens of Adelsberg cave has vestiges of eyes, but in the young they are more distinct and somewhat larger than in the adult.

In these cases we have the simplest and clearest possible proof of the descent of these blind animals from ancestors which lived above ground in the light, and which had perfect eyes.

It is evident that the cases we have cited, and many others, afford the strongest proof of the theory of evolution in general, and that the change of environment, inducing disuse of the eyes, with

isolation, preventing mixture with out-of-door forms, is sufficient to account for new species and genera.

Such forms as we have instanced, forced to live in peculiar habitats or stations remote from their congeners, were prevented from crossing with others of their species. Very soon, owing to isolation, the swamping effects of intercrossing wholly ceased, and only those in which the eyes had begun to degenerate or had already degenerated can interbreed. After a comparatively few generations, therefore, owing to isolation, the partially blind forms became fixed by heredity, and by the very force of heredity a new species or genus originated.

And so it is with deep-sea blind animals, with parasite animals, and many others living exposed to the peculiar circumstances. Change of climate, with isolation, also has excited a great effect. It is perhaps not an extreme statement to make that nearly, if not quite, half of the species of plants and animals are derived from climatic varieties. These agencies in the transformation of species were recognized by Lamarck a century ago, when in 1801, he boldly published his first essay on the subject.

But these studies should be carried on by experiments in our laboratories. Already it is well known that the protens kept in light gradually becomes somewhat darker, the pigment cells forming anew. Whether so elaborate and complex structures as eyes can be restored remains yet to be proved.

Most interesting results may be expected from the extensive underground laboratory established by M. Armand Vire in the catacombs of Paris. Here are all the conditions of cave life. In descending into the catacombs we soon were in the passages—dark, not too dry—water having been introduced, and with an even temperature through winter and summer. Here had been colonized insects

FAMOUS AQUEDUCT

The Croton River is Thus Conducted Many Miles—Immense Artificial Channel.

THE term aqueduct is perhaps more commonly understood to mean a bridge of stone, iron or wood, for conveying water across a valley. But a pipe, or open channel, or a tunnel through a mountain is equally an aqueduct, if its function is to convey water from one place to another. All great aqueducts have been constructed for the purpose of conducting water from some more or less distant source to large towns or cities. The term is also properly applied to a

bridge carrying a canal for the purposes of navigation.

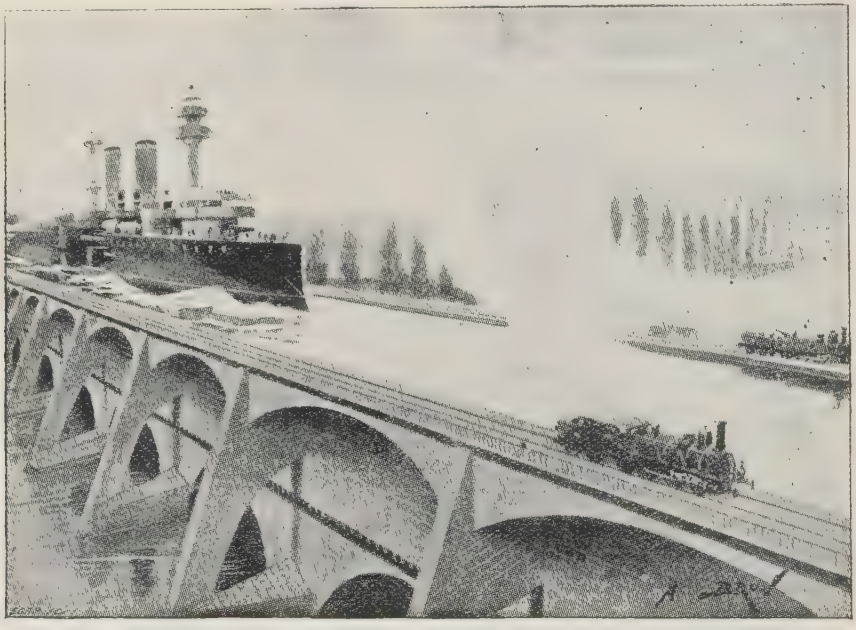
New York is supplied with water from the Croton River, which falls into the Hudson. The aqueduct was constructed between the years of 1837 and 1842. It is 38 miles long, with a declivity for the greater part of its course of 13¼ inches to the mile. For a length of 33 miles the water channel is 8 feet 5 inches in height, and 7 feet 8 inches in greatest breadth.

Stone, brick and cement are used for the encasing masonry, which varies slightly as the channel is formed in the rock, or earth, or in an open cutting. In flat valleys the built conduit has sloping earth embankments on each side. When it reaches the Harlem River the water is conveyed in iron pipes over a splendid bridge. These large pipes also connect the receiving and distributing reservoirs, which are two miles apart.

The first Croton aqueduct, though justly considered one of the grandest modern works of its kind, has been found to be totally inadequate for New York. Accordingly, a new aqueduct on a more stupendous scale was constructed subsequent to 1883.

A dam of vast size was built to collect the water of the Croton watershed, and for nearly the whole way from this to the city, a length of 28½ miles, the conduit or water-channel is tunnelled through solid rock.

For the most part this channel is fully thirteen feet both in height and width. A certain length of its more southerly portion, however, is quite circular, with a diameter first of 12 feet 3 inches, and then of 10 feet 6 inches. This conveyance for water to supply the city is justly regarded as a great engineering achievement.



LOCOMOTIVES DRAWING A BATTLESHIP OVER A VIADUCT.

VIEWS IN THIBET

Valley in East Nepal—Thibet Mastiff—Carrier Goat—Buddhist Idols. Lepcha Girls—Himalayan Mountains—Cane Bridge in Thibet.

THIBET has been called the "great closed land," so few have been the travelers and explorers from Europe who have visited it.

The mighty Himalayas shut it in from the south, a granite snow-crested bulwark 75,000 feet high. Even the few passes are so steep and stormy, and the air is so rare that climbers can go only a few yards at a time, and blood oozes from the ears and mouth.

High mountains close it in on the east and west, and the terrible desert of Gobi and still more mountains protect it from the north.

It is a vast table-land, three times the size of France, as high above the sea as Mont Blanc. The greater part is stony and barren, and the grass growing upon it becomes in winter as dry and hard as wire. Hardly a tree can be seen for miles. There are many great lakes. Koko Nor is 750 miles round. The sheltered valleys, however, produce wheat, barley and peas, and round the villages are extensive forests of rhododendrons and apricot trees. The dried fruit of the latter supply food for the winter,and the kernels, crushed, yield white fragrant oil, which the villagers use for cooking, and also to rub the dark skins of their never-washed children.

The population can only be guessed. It may be a million and a half; fifty thousand of whom are nomads, always wandering with their flocks of sheep, goats and camels, and living in yurts, large skin-covered tents.

The Thibetans belong to the Mongol family. In figure they are short, little over five feet in height. They have round faces, flat noses, and wide mouths. Men and women dress alike in trousers, mantles and girdles round their waists. The men glory in their long pigtails. In the winter the poor wear sheepskins with the wool inside. Amber necklaces, large ear-rings, and fantastic silver-head ornaments are the women's ambition.

The daily food of the people is tsamba and brick tea. Tsamba is a greasy barley cake, eaten nearly raw, and their brick tea is boiled with salt and butter or mutton fat, beaten in a churn till the mess is thick and sticky, when it is greatly enjoyed. Every Thibetan carries in the bosom of his dress a wooden cup for tea or tsamba, which is never washed. Butter is always kept till it is rancid. The staler it is the higher it is valued; skins

of it are kept forty, fifty or sixty years, to be opened as a dainty on great occasions, at family festivals, or funerals.

They drink to excess a dangerous kind of beer called "chang." Their drinking habits and their utter want of cleanliness

are the worst vices of the Thibetans. On the other hand, Miss Annie Taylor, a lady missionary, who lived amongst them for years, says that in many respects they compare favorably with other Eastern peoples. They are truthful, honest, good-natured and industrious. The Moravian missionaries declare that if they borrow they pay before the time allowed has expired.

Their Chief Wealth.

The chief wealth of the Thibetans is in their flocks and herds. They meet together in the autumn at their great fairs and barter their wood, gold, musk, yak-tails and goat-skins, for rice, sugar, spices and salt. From China they buy tea, silk handkerchiefs and porcelain; from Bengal, cotton, broadcloth, iron, rice, spices and tobacco.

The yak is their greatest treasure. It is a small ox, hardy, but fierce and evil-tempered. It is very sure footed and climbs the dangerous mountain paths, carrying burdens of two hundredweight. The Thibetans ride it like a horse. Its milk is as rich as cream and makes excellent butter. Its hair yields fine silky wool, and it has a huge bushy white tail. Large herds roam the plains around Koko Nor.

There are also antelopes, wild asses, bears and foxes. Northwest Thibet is the only place in the world where wild camels can be found. The Thibet mastiff (see ill.) is a very fine dog, guarding the tents and flocks of the pastoral chiefs. There is also a very large wild sheep, called the Ovis Argali; we show its huge head and horns.

The chief city of Thibet is the sacred Lhassa. It is almost unknown to Europeans. To enter it is to endanger one's life. It is six miles round. The main streets are wide, with avenues of trees. The great temple of Patala at Lhassa stands on a high hill. It is really a temple and a cluster of monasteries, with five gilded cupolas that glow in the sunlight like fires. In it is an idol seventy feet high. $55,000 are spent every year in its religious ceremonies. The king-pope of Lhassa is the Dalai Lama; he is generally a youth, and is kept closely shut up from all his subjects.

There are many lamasarirs in Thibet. These are fortified monasteries, generally on high hills, and are very large, populous and rich. The lamas are supposed to be holy men, and very learned; but in reality they are both idle and ignorant. They recite endless prayers, keep burning thousands of lamps, fulfil other men's vows for money and presents.

Curious Prayer Wheels.

The great religious superstition of the people is that of their prayer-wheels, a specimen of which you can see in our picture. Some are so small that they can be held in the hand; these are often made of gold or silver. Others are large and made of wood or metal. They are found in every house, and each visitor politely gives a turn or two to his friend's wheel.

Sometimes as many as a 150 prayer-wheels are to be seen in a row. Often they are gigantic things, erected in special buildings, and turned by water or wind-mills.

On these wheels are written the short Buddhist prayer, called the "Mani." Some of these wheels contain 10,000

manis, so that when a wheel is turned once around, 10,000 prayers are thought to be offered. The words, "Om mani padmi hum," are not understood by the people. Translated they mean, "God the jewel" (or the dewdrop) on the lotus.

Pilgrims spend years in carving these words on the rocks and mountain sides. The Thibetan sacred Scriptures are in 108 volumes. When a learned lama dies, he is buried under a fantastic monument, called a chait (see picture); his disciples visit and recite Scripture at his tomb.

The centre subject of our illustration is the vast range of the Himalayas, as seen some thirty or forty miles from the south, guarding the great hidden land. The top subject is the first view of Thibet after crossing the high passes to the north of the range.

Lower down we show the valleys from the Darjling and Likin side, inhabited by the Lepcha tribes, of whom we give a group of girls. Lastly, down these valleys roars and leaps many a dangerous torrent. The men of the country make most ingenious hanging bridges of cane and ropes.

We show one that may be called a living bridge, because it has been twined out of the long, hanging roots of the trees on either side.

The Moravian missionaries have done a good work in Thibet; other societies have posts along its borders. The people are friendly, but the lamas are very jealous. The Moravians say that the superstitions of the Buddhists are breaking down, and there is hope that Thibet will cease to be the great closed land.

ONLY COMPLETE BUDDHA TEMPLE IN AMERICA

Cost $500,000 and Forty Years of Labor—Curious Images and Carvings Symbolical of Religion.

"NAMU amida butsu. Nami mio horen gekio."

A sturdy little Japanese wearing American clothes stood in reverential pose before the figure of his god in the Buddhist temple at the Free Museum of Science and Arts in the University of Pennsylvania. He solemnly murmured his daily prayer. Translated it is: "Remember me, oh Buddha, and forever I shall follow thy words and laws."

But the Buddhist temple shown in the collection at the museum is not a make-believe one. It is in reality a complete "ji" or sacred place of worship, the only one west of Suez. Visitors from India, from Siam, from Burmah, China, Korea, and Japan pause reverently at the door

and enter the holy place with the same awe and pious thoughts that would spring to their minds in the far off Kioto or Mandalay.

Japs Very Devout.

The Japanese of Philadelphia, who, as a rule, are especially religious and devout, are constant worshipers at this shrine of Guatama. Japanese students at the University slip quietly into the building, offer their prayers unostentatiously and then leave as quietly. It was during one of his devotional moments that the photograph of Harumasa Otaki, the celebrated student of old Ceramic art of Japan, was secured. It is valuable when considered as an art production.

In only two details does the worship of the Orientials here differ from that in their own homes. In the first place, there is no offering of money, such as is customary in all Asiatic lands. In the second, there is no priest to act as intermediary between the worshiper and the Buddhas. Perhaps some day a priest will be installed in the temple, and should this occur he would find every delay, prayer taken, drum, gong, sceptre, hossu, books of prayers and gokos required for the service.

This temple, which is unique outside of Buddhist countries, represents the result of forty years of work and the expenditure of half a million dollars upon the part of Maxwell Sommerville, Professor of Glyptology of the University of Pennsylvania. Every one of the hundreds of sacred implements, statues, paintings, embroideries and carvings was secured from temples "somewhere east of Suez." Many of them came from the cities to which Professor Sommerville has been the only American visitor.

Forty years of search and labor to bring the temple to completion—why, that is a lifetime! Yet this monument of a Philadelphian's zeal, learning and wealth is the only temple west of Suez where the Buddhist may worship before a chancel that is fully equipped. Both Germany and France envy this city its possession of the treasure.

This famous temple is in the west wing of the Free Museum of Science and Arts, in a room especially set aside and arranged for it. The daylight is excluded. After viewing the shrines of Asia, on entering Professor Sommerville's Buddhist temple one is impressed with the charming effect of myriads of concealed incandescent lamps, whose tender religious light blending with the colored lacquers in pale green, in red dragon's blood and turquoise and rich gold on the effigies, all convey to the visitor the dream of an Oriental chancel, replete with important symbols for whatever devotee may approach the sacred precinct. At intervals strains of music fall upon the ear. The symphony is heightened by the tones of the great metal bowl bell, like "A voice from heaven," which, gradually subsiding, symbolize the distant sound of a melody from a Tennins or angel's flute

Menacing Children.

The worshiper enters through the heavy wooden gateway that faces the south, which bears this significant inscription: Fuku Roku, Ju (meaning "happiness, wealth and long life.") One then passes three huge and menacing temple guardians made of bronze and wood.

These figures brandish hatchets in the faces of the faithful to remind them that this is a holy place.

In Burmah they have other reminders in addition to these guardians. The steps leading to the temple doors are usually very long and steep, and instead of being of equal height and breadth, they are made as irregular as the skill of the architect can devise. Some are high, some are low, some are broad, some are narrow, and the Buddhist must take heed how he steps, or he will stumble and fall.

Cleansing Ceremonies.

Passing the guardians, the worshiper comes to a stone cistern containing water, where he must cleanse his mouth before addressing "Buddha, the Blessed Lord." Then, after drying hands and face on the sacred towels that hang from the racks beside the cistern, he passes directly to the chancel rail. These, more than one hundred towels, in many colors, form a strange collection of Buddhist art in linen and muslin.

In front of this rail is a deep box, lacquered in red. It is about six feet long and two feet wide, and access to the interior is prevented by a series of strong bars. Into this box the devout person should throw his offerings in money for the support of the temple, and even at the University many contributions are dropped into the box by the faithful and the curious.

The chancel itself is surrounded by a red lacquered rail, to which the worshiper comes, and, with bowed head, offers a prayer to Buddha. Women and some of the more extreme devotionalists kneel to pray, but it is usual with the Buddhists, as with the Moslems and Jews, and even in certain forms of Christian worship, to pray standing.

Hard to Understand.

It is hard for the Occidental mind to understand Buddhism. The very fact that Buddha was reincarnated three hundrrd and sixty times in various forms and under various names appals the Western mind. In the Sommerville temple there are a number of images of Buddha in many of his forms. The principal statue is that of Jizo, which sits in the very centre, a figure of exquisite bronze, parti-colored, with his head surrounded by a nimbus or halo, on which are Sanscrit characters. In one hand he holds a Shakujo, or priest's sceptre, and in the other the jewel known as the peach. Jizo is Buddha, the compassionate, who aids those who are in trouble, the patron of travelers and of mothers and children.

Directly in front of Jizo is the altar for offerings, with rare porcelain cups with fine lacquered covers for tea, and plates for rice, fruit and lentils. There is also a goko, which is the Buddhist symbol for the irresistible power of incessant prayer. Close beside this are two exquisite lotus flowers, carved in wood, lacquered and penciled in natural colors.

A volume could be written on this flower and the uses to which the Buddhists put it in their religious decoration. It is far more generally used than any other object. It is embroidered, carved, painted, moulded and etched on almost every object of interest in the temple.

On either side of Jizo are other incarnations of Buddha. They are massive golden statues. On the right is Monju,

the apotheosis of transcendental wisdom, seated on a lion, while on the left is Fugen, the divine patron of those who practice a worship of ecstatic meditation.

In vases of costly and splendid character within the chancel are great bunches of flowers. There are gold bronze lotus flowers, worked so craftily that they appear to be real—leaf and stem suddenly turned to metal. In another vase is a second large bunch of the same blossoms carved out of wood and colored in perfect imitation of nature.

Perfect Artificial Blossoms.

In another vase is a bunch of artificial plum blossoms of exquisite perfection that symbolize constancy; for the plum tree of Japan puts forth its flower at a certain time regardless of rain or shine or snow or ice.

Perhaps the most remarkable thing in the whole temple is the figure of a white elephant moulded life size. In one of his many incarnations Buddha was born in the form of a white elephant, and this striking status in the temple is a reminder of that fact. Colored as in nature, with trunk erect and mouth open, the elephant lies half on its side. Several of its teeth have been plugged with gold, as is done in their palace homes at Bangkok, where the sacred elephants are cared for, a nobleman being assigned to each to guard and see to its comfort.

The figure of the elephant, together with that of the white horse, is, with the lotus flowers, the great symbol of Buddhism. And as every Buddhist believes that in some future state of metempsychosis his soul will (as that of Buddha) pass through the body of some beast or insect, animal life in Buddhist countries is held sacred.

There are numerous stone lanterns varied in form and dimensions, with the spirit names inscribed deeply on them. There are also wooden sotobas souvenirs of the loved departed. They are formed of the crescent, pyramid, sphere and cube. Larger ones record the beneficent acts and contributions to the temple of those who have aided in the support of the shrine. There are also hung banners that are gifts of merit-makers, those who pay for the welfare of their souls.

But most curious of all are the stone and terra cotta figures from a temple near Nara, illustrating vicarious prayer. At this temple a rich man who cannot afford the time necessary for prayers at the chancel is, for a fee, permitted to place a figure in stone or terra cotta representing himself, which is supposed to pray vicariously for him.

Magnificent Panels.

On the wall behind Jizo are hung three magnificent Rammas, or carved panels. They are cut from solid blocks of wood in high relief and colored and gilded. They are three hundred years old, and were secured from a temple in Nara. The subject of the three is the welcoming of Buddha incarnated as Amida and heralding the glad tidings to his followers.

Directly beneath these is Fudo, seated in a blaze of flame, to signify his invulnerability, accompanied by the youth Kongara, in red, leaning on a staff, and Seitaka in an attitude of prayer.

It is a place of deep interest, this temple at the University of Pennsylvania. Days might be well spent in studying the

detail of each separate article, and a library might be written upon its contents. Yet the generosity of one citizen of Philadelphia, Professor Maxwell Sommerville, has placed within the reach of all this wonderful monument of a life's work.

WONDERFUL FEATS ON THE BICYCLE

Extraordinary Agility and Skill—Riding With Head Downward and Feet in the Air—Circling Around on an Incline Plane.

THE world's most famous trick bicyclists are the Kaufman family, whose marvelous feats have astonished all spectators. Among Kaufman's favorite tricks is to ride or rather jump with his machine on a table over three feet high.

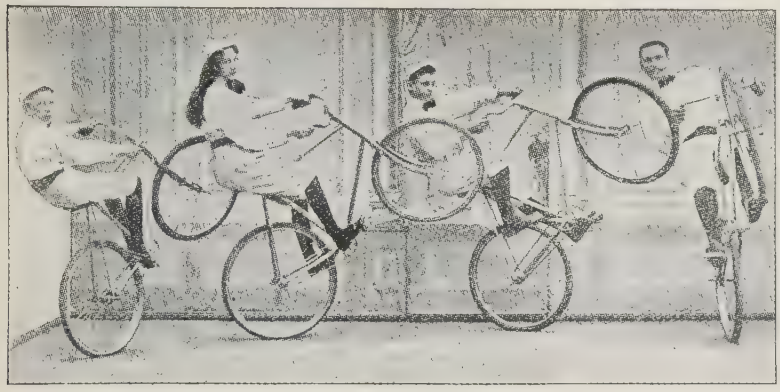
His troupe includes, besides himself, Frank, Wallace and Minnie Kaufman. Together they have created a sensation wherever they appeared. During an engagement they come simultaneously on the stage, all awheel, riding around at a terrific rate, when suddenly they run together, forming a star. After being stationary for several seconds they retreat and the male portion of the company stand on the handle bars, the machines going around from the momentum they received.

Then they will ride around with the forewheel uplifted. One rides on the shoulders of another also with uplifted forewheel. The final consists in a sort of walk-around with one of the troupe on the wheel and the rest of the troupe forming a pyramid on his shoulders.

Kaufman is quite as much at ease apparently whatever he rides, a complete machine or merely some fractional part of it, and his illustrations of what can be done with a mere detail of a bicycle are as interesting as they are exciting. The members of the company form a manœuvre composed of the following figures: Ronde, Tour de Main Contre-Ronde, Grand Chaine and Moulinet; then they approach in the form of a star, whereupon the male members of the troupe mount the saddles and spokes of their front wheels as a climax. The undoing of this star is certainly hard, but it is always done successfully, and performances of various kinds follow, ending with many hard twists and turns of the machines in the front of the stage.

The Kaufmans have appeared in every part of the world, and as a proof that traveling and hard work are good quote

the fact that not for a dozen years have the services of a doctor been requisitioned for any member of the troupe. It is also



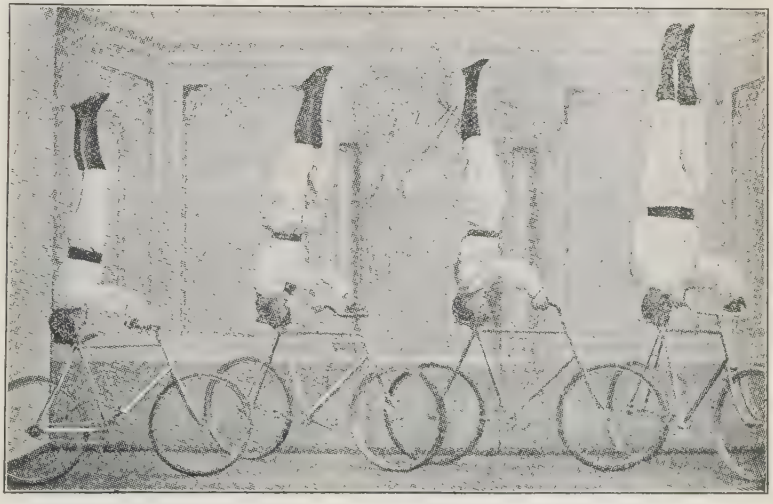
KAUFMANN TRICK BICYCLISTS.

something of a record to be able to say that they have never had an accident of any sort, which is the more remarkable seeing the hazardous nature of many of their feats. All are fine linguists and musicians.

In an article entitled "The Man on a Wheel," published in one of our periodicals, the writer, who is an expert cyclist, comments as follows:

"An interesting correspondence has taken place in 'Cycling' in respect to the effects of swimming on bicycle riding. It has been discovered by a good many bicycle riders that, after a morning swim in the sea, cycling tires them quickly, and they have little inclination to go for a spin. Last summer, when I stayed for a couple of months at an East Coast village, I experienced pretty much the same thing. My plan always was to ride a couple of miles or so on my machine till I came to a deserted spot. This little ride was always enjoyable, but after my swim and as I rode back again I felt a lassitude of muscle as though I had done an excessively stiff run the day before.

"This, it seems, is quite common to men who swim and cycle. It is due, I rather think, to the fact that quite another set of muscles are brought into play while swimming, and it is these that are tiring you when on the machine and not the cycling. Some people say that if you only persevere with the cycling after swimming the feeling will gradually pass away. I tried it for two months, and I must say in my case it



THE KAUFMANNS' WONDERFUL FEAT.

remained and did not disappear the whole of the morning. It was not until after lunch that I felt cycling to be not a weariness.

"Ladies, not being such strong riders as men, often have difficulty in climbing hills, and dismount rather than keep on struggling to the summit. Now and then, one comes across a male rider doing his best to give his companion a shove, but, as it is usually unsuccessful, the purpose is soon abandoned.

"A towing device has just been placed upon the market by a Philadelphia firm. The cord is carried coiled upon a reel, which is attached to the main down-tube of the frame by a screw-clamp just below the saddle-lug. A strong spring is used in the reel to take up the coil after use or to keep the cord taut. When the cord is nearly all out, the spring furnishes sufficient resistance to secure tension, which is said to obviate jerk. The clamp by which the cord is attached to the frame of a wheel is adapted to different sizes of tubing, and can be instantly attached or detached.

"The reel is two and a half inches in diameter, three-quarters of an inch thick.

EXTRAORDINARY CYCLING PERFORMANCE ON A TRACK BUILT AT AN ANGLE OF SIXTY DEGREES.

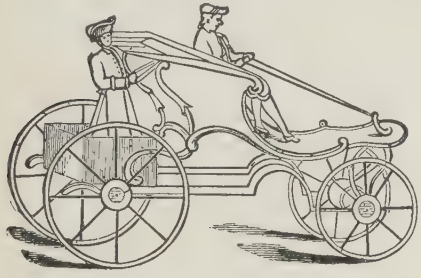
The cord is made of fine flax, and is claimed to stand a strain of over one hundred pounds, though only one-sixteenth of an inch in diameter. It is attachable without either rider dismounting; the hook is drawn out of the reel a foot or two, and placed round the head of the machine to be towed. The cord is eight feet long, but the pulling tension is reached before the full length is out of the reel."

Mention has been make of the Kaufman family and their wonderful performances. Another rider of equal skill and daring is Mr. Charles Jones, who performs on a track built at an angle of 65

degrees. The accompanying illustration furnishes a good representation of it.

Mr. Jones' most extraordinary feat consists of removing the upper portion of his clothing while cycling at full speed, without using his handle-bar.

Every rider who begins cycling when



QUADRICYCLE—1776.

young has, as in all athletic pursuits, the advantage over those who start later in life. He has the elasticity of frame to learn without unduly straining himself, and he acquires such proficiency that cycling becomes a part of his ordinary motion. With the exception of horse and pony riding, we can call at the moment no one pastime which appeals equally to the old and young, except cycling.

Many of the pastimes of youth, such as marbles, leap-frog, etc., the boy as he grows to manhood, ceases to care for, and on the other hand a youth has to grow up before he takes kindly to shooting and such like sports. But in cycling extremes of age meet, and both derive in their separate ways pleasure and physical benefit from the wheel. A boy only thinks of whether he likes a pastime, and never whether it does him any good, physically speaking.

When going on a tour the first thing to decide is what will be most enjoyed, good scenery and medium roads; good roads and medium scenery, or what? No fixed distances can be laid down, as the wind, the state of the roads, or the advent of rain may play an unrehearsed but effective part in the proceedings of any day. There is nothing that differs so much in its capabilities as the human stomach, and therefore the sooner the better a boy starts on the principle that he will be either a fool or a physician at forty, if he does not ere that period ascertain what he can eat to the best advantage.

It must, therefore, be a great pleasure to parents to know that in the indulgence of cycling their children, male or female, are not only getting amusement, but also gaining health. It was unfortunate for cycling that the hobby-horse, which placed a man in the worst possible position, namely, straining his leg whilst it was extended to its utmost, should at the outset

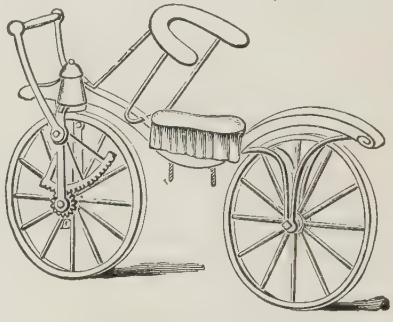
CELERIPEDE—1816.

have prejudiced the medical profession against cycling.

Now, however, almost without exception, the faculty are practically unanimous in its praise; many well-known members who could be named being absolute enthusiasts. The advantages of

cycling are now no longer a moot point, and in the words of a well-known physician, every person "can ride with benefit to himself, except those suffering from consumption and heart disease, or who are decidedly prone to apoplexy." So long as a watchful eye is kept on the young rider to see that he does not over-

DRAISINE—1816.



HOBBYHORSE—1821.

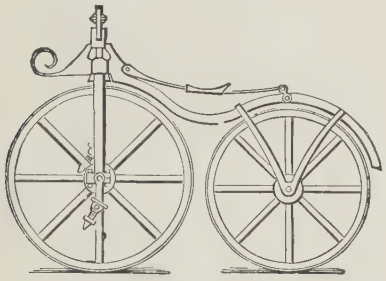
do it and that he suffers no inconvenience from his saddle, there is no cause for anxiety.

There are not many regular schools for teaching nowadays, but most venders of machines will make arrangements for a purchaser to be taught by one of their men. Failing this, however, it only requires the assistance of a companion (two for choice) a little stronger than the learner, to enable one novice to easily teach another. The best preliminary step is for the learner to wheel his bicycle and letting it fall gently towards him, to feel it spring upright again as he turns the front wheel towards him; that is, the same way the machine is falling. He will then realize better than he could whilst in the saddle how a bicycle rights itself. His wits are clearer when on *terra firma*.

Having thus gained an idea of how a bicycle is kept on end, the learner, with a friend on each side of him, can seat himself in the saddle, seeing first that it is at a proper height. The beginning and end of ease in cycling depend on this, and the gauge is as follows: When the rider is seated on the saddle, the centre of the bottom of his foot should just be able to touch the pedal at its lowest point. In pedalling, however, he uses the ball of his foot, that is. midway between the centre and the toe ends, and this enables him to use his ankles as well as his thrust of leg; but ankle action comes later—not in the learner's stage.

Every modern machine is made with handle-bars so wide that no contraction of the chest can occur in holding them; but riders should insist on the handles being capable of being raised so high as to obviate the necesity of craning forward. When spurting, as later on in his career the novice will, he will crane forward, but he should be able to avoid being obliged to do so at other times. Many modern machines are faulty in this respect—handles too low—as regards comfort, appearance and health; but it only requires a buyer to insist on a longer tube for adjustment of his handles to be comfortable. Learning to ride is the

easiest part of early cycling. Mounting is the most difficult, and next comes dismounting. With a professional teacher



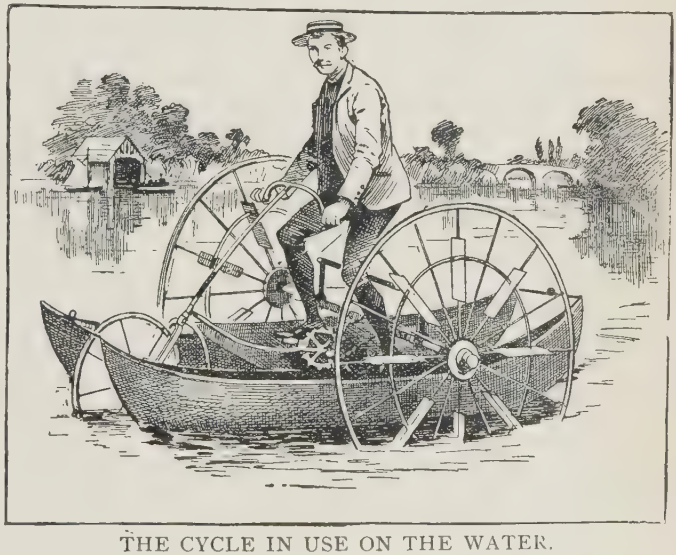
LALLEMENT'S VELOCIPEDE—1866.

inside a room the rider will be always on the turn, which although increasing his earlier difficulties, makes him a better rider when left alone than if he had learnt on a straightway course. If he learns in the street let it be in a secluded one, with a very slight slope. Here with a friend or friends to hold him up, he will soon acquire the balance, but if he has a fall or two it will give him confidence by letting him know the worst that can happen. It is useless going on learning when fatigue sets in; either rest awhile or stop till next day. An hour at a time when learning is enough for anyone.

Between Mount Holly and Smithfield, New Jersey, there is a railway for the use of bicyclists. The single rail is mounted on a fence, and the bicycle is inverted. Each passenger is his own locomotive, and thus combines exercise with travel. There is no danger of falling off and no trouble about steering, so that the passenger can freely look about him and enjoy the air. It is proposed to double the track for going and coming passengers, and to provide stations at intervals with supplies of vehicles.

The combined tricycle and boats shown in the figure is an American invention for road and river travel. Twin boats are fastened to a tricycle having wheels fitted with paddles, and when in the water they can be guided by the steering wheel, which is made as a circular disc. The boats can be disconnected from the tricycle at will, and serve to hold luggage, fishing tackle, and other paraphernalia.

It is evident that the bicycle has come to stay. No new method of locomotion ever leaped so rapidly into public favor. While there have been differences of



THE CYCLE IN USE ON THE WATER.

opinion as to the physical advantages of cycling, the weight of this opinion is decidedly in favor of it. The exercise is healthful, when not overdone. Even walking may be overdone, and is liable to the same objection that might be made against the wheel. A person must know when his ride has been long enough, and

BICYCLE OF 1885.

knowing this he should have will power enough to stop.

It is nothing uncommon now to see business men in all parts of our country making use of the bicycle. It gives promise of a more robust health and a better physique.

Cycling has a short but brilliant history of the past. In endurance man mounted on a cycle has beaten the strongest and fleetest of domestic animals—the horse—out and out in a twenty-four hours' ride. What horse could compete against a cycler who covers, as some have done, over 300 miles a day? Horses have trotted a mile rather faster, but where is the horse which could cover forty miles under two hours, as not one but several cyclists have done in the fifty miles championship? What horse could turn out morning after morning, and trot or gallop to the tune of over a hundred miles a day, as have some cyclists in the past few years? A practical knowledge of cycling tends to increase one's wonder at these "giant performances."

In the bicycle, as in every other form of machine, constant improvements are being made. Old things are passing away and newer and better things are taking their place. The locomotive of to-day is not what it was fifty years ago; the old time plough and rake have given way to better agricultural implements; carriages that our grandfathers rode in have been replaced by horseless vehicles. Turn where you will you see the march of improvement.

BICYCLE OF 1902.

The first form of bicycle, a picture of which is presented to the reader, is a very different looking affair from bicycles

that are now in use. Once it was thought that a man must be mounted skyward on a wheel of immense diameter in order to achieve the best results, ride the easiest, and make the best time. The wonder is that such a vehicle, with the seat so high and the strength required to run it, should ever have been used at all. Many a rider has strained his muscles and almost broken his back while seated on his high perch.

The old time bicycle is not seen any more, and is known only as a curiosity of days gone by. Let it be put in its stable and there remain. Nobody wants it, for the reason that we can all obtain something better. The modern vehicle came to stay and to replace its ungainly predecessor. With its rubber tires and its score of little inventions, all of which are an improvement upon what have gone before, it is no wonder that the vehicle became popular and has been ridden persistently. Our illustration of the modern bicycle furnishes a good idea of its improvement over the old style.

WONDERFUL X-RAYS

Light Sent Through Opaque Substances—Interior of the Human Body Revealed—Invaluable Aid to Medical Science.

"WE are in the beginning of an era when cancer will have no terrors. In the last year and a half I have treated over fifty cases of cancer, including many forms of the disease, and have yet failed to find a single one that would not yield readily.

"I am of the belief that the disease can, in the future, be broken down quickly and surely, even when treatment does not begin before the disease is well advanced."

This confident statement was made by Dr. John E. Gilman, of Chicago, professor in the Hahnneman Medical College, in referring to the results of his experiments with Roentgen rays in the cure of cancer.

The case of a lady whose cure was signalized by the presentation by her husband to the hospital of the valuable X-ray machine with which the cure was made has attracted wide attention.

The method is simple. The patient is given remedies which will supply material needed for the rebuilding of the destroyed tissue, and he is subjected to the influence of the X-ray every day for a few weeks or months, as the case may be, in order that the cancer may be destroyed. Surface cancers are the only ones that can be reached.

"The Roentgen rays," says Dr. Gilman, "are of great power in the destruction of disease germs. I have found them

of great value in killing the germs of tuberculosis.

"The X-ray pours light and electricity through the cancer and destroys the germs, at the same time stimulating the activity of the starved parts. The medicines which I give during the treatment, and which vary with the different patients, supply the material lacking in the system for the restoration of the normal tissue."

The Great Discovery.

Early in 1896 it was announced that Professor Roentgen, of Wurzburg University, Germany, had discovered a method by which certain substances could be photographed, not merely showing the exterior surface, but also the interior substances. As the composition of the rays of light was unknown, these rays were designated by the algebraical term of X, meaning an unknown quantity. The discovery caused great interest throughout the world, and immediately experiments were begun in many places, especially by professors in medical schools.

It was soon ascertained that some parts of the human body—for example, the hand—could be photographed and all solid substances beneath the flesh could be distinctly seen. In this way the bones of the hand are reproduced, and if there should be such a solid substance as a bullet of lead, it can be located and extracted. The importance of this discovery, especially to medical science, cannot be overestimated.

Experiments were carried on at Yale College with the following results: One of the professors laid a sensitive photographic plate horizontally in a wooden box, placed the object to be experimented with on top of the box, and suspended his Crookes tube above them both. He then turned on the electric current, which generated the newly discovered rays in the tube, which, in turn, threw them upon the objects below.

In the first experiment Mr. Bumstead used a leather pocketbook containing several coins. He thus photographed the coins, the rays going completely through the leather, the resistance of which was trifling compared with what it would have offered to light. He also photographed in the same way a pair of eyeglasses in their case. The result showed that the glasses were photographed, while the case was scarcely visible. A lead pencil was experimented on, and the result was an excellent picture of the lead, with the wooden portion dimly outlined.

PHOTOGRAPH OF HUMAN HAND, SHOWING THE ANATOMY IN DETAIL.

A couple of English walnuts which had never been opened were exposed, and a splendid view of the kernels was obtained. All these exposures lasted about an hour. The experiments were carried on in open daylight, the plates, of course, being kept from the sun in an ordinary holder.

Looking Through Animals.

Probably the most interesting of Mr. Bumstead's experiments were those with animals. For this purpose he used a fish, a mouse and a frog. After the usual exposure the backbone of the fish was easily distinguishable.

The frog picture displayed a portion of the skeleton with more or less vividness, the plainest parts being the leg bones. The most distinct part of the mouse's skeleton was the skull, which could be traced with little difficulty. The little fleshy nose of the mouse did not give nearly as much resistance to the rays as the bone, and this fact was the most useful result of the experiments.

One experimenter relates the result as follows:

"My last attempt has resulted in giving me a perfect photograph. I used as a subject the leg of a man which had been fractured in a railroad accident two years ago. The fracture was in the upper third of the tibia, or, in other words, in the large bone of the leg a few inches above the knee. I placed an ordinary camera on one side of the leg and directly opposite on the other side of the member I placed the tube at a distance of three or four inches.

"The result was a clearly defined photograph. The bone appears rounded and not flat, as in the shadowgraphs heretofore produced. The fracture is perfectly plain. It can be traced all around the bone. The surface of hardened lime salt, which forms after a fractured bone has been set, shows clearly.

"Then comes the most remarkable part of the photograph. Running down each side of the bone is a line showing the location of the marrow. The marrow is darker in the picture than the bone itself.

"Then, through the marrow a dark line can be seen, showing the mark of the fracture on the opposite side of the bone. In the centre of the bone are two spots, plainly discernible, showing the fibrous tissues of the nerves."

Important Results.

A standard medical journal comments as follows, upon the advantages of the discovery:

"As far as our present knowledge goes the positive advantages to medicine seem to be limited to three conditions: fractures, dislocations, and tumors of bones, encysted bullets, needles or pieces of glass in the tissues and earthy calculi.

"As a means of ascertaining that the parts had been placed in proper position after adjustment, it would, however, be most valuable, for of course all splints and dressings, except plaster or metallic splints, would be as 'translucent' as the soft tissues themselves. Its principal value, however, would be in obscure cases with much swelling, 'green-stick' fractures for instance, in partial luxations, and in medico-legal cases when the proper setting of a fracture or reduction of a dislocation was in question.

"In the locating of bullets, some brilliant results have been already recorded,

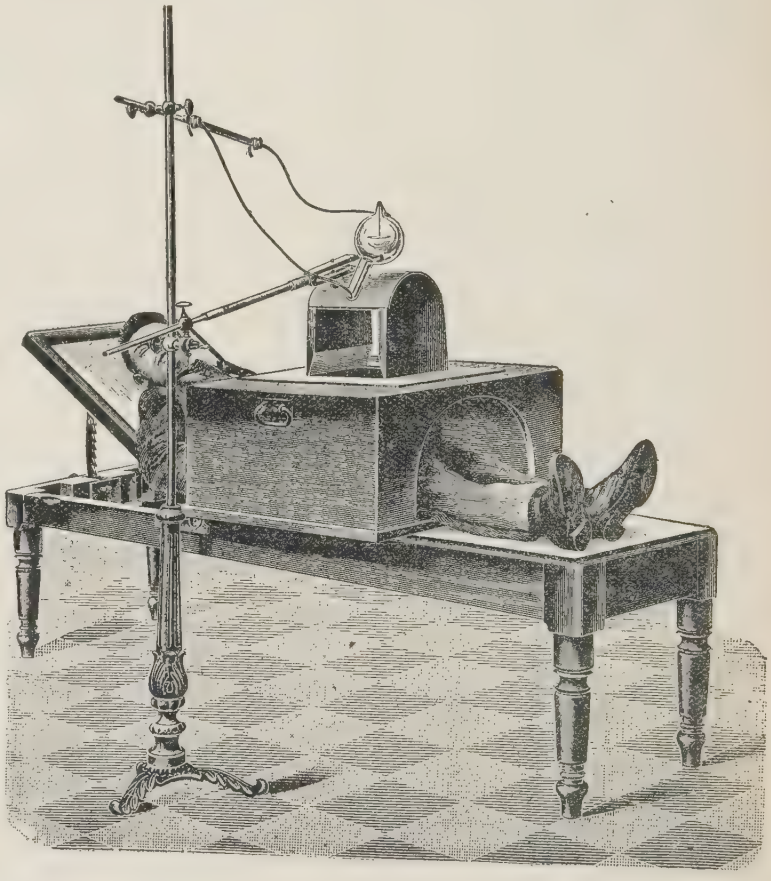
in which the bullet beyond the reach of touch or probe has been found by the X-ray and successfully removed."

One experiment at Berlin, Germany, located a needle in the stomach of a young woman which caused great irritation and incessant expectoration of blood. It was determined as a last resort to bring the patient to the Roentgen laboratory in the hope that the X-ray would locate the needle, and that it might be extracted without endangering the young woman's life.

The plate plainly showed every bone of the upper part of the body and the needle was found lying point downward in the lower right angle of the stomach.

Surgeons being present, it was resolved to remove the needle at once. The patient was placed under the influence of chloroform, and the cause of the excruciating sufferings which threatened her life, was taken from the stomach by skilful surgical manipulations.

The statement has been made that if, at the time President Garfield was felled by an assassin's pistol, this method of photography had been in use, the bullet could have been located and doubtless the life of the President could have been saved. The probes of the surgeons were of no avail; they were working in the dark. No such fatal result could have happened if this new discovery had been known at that time. Its effects upon medical science are of the most marked and beneficial description.



APPARATUS FOR APPLYING THE X-RAYS.

The announcement has already been made that success has attended efforts to photograph the brain, thus locating tumors in that organ. In fact, the whole human body is likely to be surveyed and examined in all the workings of its wondrous mechanism. A photograph will tell the surgeon just what internal parts are

diseased and will save all exploration with the knife. This, apart from the curiosity attending such a discovery, has led the scientific world to hail the new photography with delight.

The continued improvements on the Roentgen-rays have made possible their general introduction into the medical world. Their object and uses are now fully understood and the various methods of photographing have been reduced to one distinct system. To be brief, the improvements consist mainly in the considerable time saved in the exposure through the improvement of the ray induction, the production of pictures restraining the stray rays so as to form a clear relief, and the perfection of the apparatus in regard to its handling and transportation.

A box has been constructed for use in photographing any part of the body. At the two ends are openings which will admit the body of a person to comfortably rest there while being photographed. On the top of this box there is a sort of opening which holds the plates that are used. The practical uses of the X-rays are not confined to surgery alone, but gout and rheumatism have been cured by their application.

YOSEMITE VALLEY

The Switzerland of America—Magnificent Scenery on the Pacific Coast—Celebrated Glacial Point.

SUPPOSING that exercise is toughening us into the endurance of almost any reasonable amount of physical fatigue, and that the great sights witnessed much more than compensate us for the toil expended in reaching them, let us set out for a sight of the Yosemite Valley —at least in imagination—for if any of us wish to see Yosemite in its glory, from a precipice of nearly four thousand feet, and by climbing to the top of the Sentinel Dome look upon nearly every prominent peak of the Sierras for a distance of fifty miles, we had better not stay behind. Leaving the hotel, we take the same course for about a mile that we did when on our way to the Vernal and Nevada Falls.

As our feet fall on the flower-covered and beautiful, though not very fertile bottom-lands of the upper part of the valley, and we thread our way through a labyrinth of oak, pine, maple, cottonwood, and other trees, the mountain walls on either side throw their awe-inspiring and heavy shadows over us, and make our hearts to leap with wild emotion and new pleasure, as though we stood upon en-

chanted ground, and all the scenes upon which we look are the magical creations of some wonder-working genii.

"'A thin mist is lying,' as Mr. Tirrel so beautifully remarks, 'upon the valley and stealing up the mountain sides.' The cliffs upon our left are all in deep shadow, the outline of their summits cutting darkly and strongly against the brilliant light of the unclouded sky. Great streams of sunlight come pouring through the openings in the cliffs, illuminating long, radiating belts of mist, which extend clear across the valley, and are lost among the confusion of rock and foliage forming the debris on the opposite side.

GLACIAL POINT, YOSEMITE VALLEY, CALIFORNIA.

"Directly in front of us, and about three miles distant, is the South Dome, the high-

est mountain in the valley, as well as the boldest and most beautiful in outline. Its base is shrouded in the hazy mystery which envelopes everything in the valley. Numerous little white clouds, becoming detached from this misty curtain, are sailing up the mountain side.

Gorgeous Spectacle.

"Dodging about among the projecting spurs, intruding their beautiful forms slowly into the dark caverns, puffed out again in a hurry by the eddying winds which hold possession of these gloomy recesses, and then resume their upward flight, each following the other with the precision and regularity of a fleet of white-winged yachts rounding a stake-boat, and each eaten up by the sun with astonishing rapidity, as they sail slowly past the angle of shadow cast across the lower half of the mountain.

"High above all this, in the clear, bright sunshine, towers the lofty summit. Every projection and indentation, weather and water stain, fern, vine, and lichen, so clearly defined that one can almost seem to touch it."

Turn where we may, objects of interest seem inexhaustible. Every new point passed, by rock or by river, has some new beauty to attract and charm us; so that even when we have left the comparatively level bottom-lands of the valley, and ascended the debris to a considerable height, views of the opposite walls over the tops of the trees reward us at every step. Ferns, mosses, flowers, and flowering shrubs are at our side.

The "shadow of a great rock" is on our left hand, giving us its refreshing shelter. Then turning past a bold, jutting promontory of rock, from whence views of great majesty are unfolded to us, our course is up the rocky bed of a ravine, somewhat steep, but perfectly safe to the very top. By sitting down frequently to rest and look about us we are constantly receiving our reward.

Reaching a shrub and tree-covered plateau we strike eastwardly, and soon arrive at the summit of Glacial Point. Before looking down let us call attention to a somewhat noticeable projecting point, that seen from the valley apparently extends out some three or four feet, but which we find when standing by it is over thirty feet beyond the nearly vertical wall. Watkins, the photographer, once ran out to the very point of this rock, and from it took one of the finest views of the South Dome and the country beyond ever obtained.

Brink of the Precipice.

Now let us advance to the margin of the precipice. We can steady ourselves by pressing against the large rock at our side or we can lie down, and, having some one to take hold of our feet, slide out like a snake to its utmost edge. It may make us a little nervous, perhaps, but taking all necessary precautions we shall find it unaccompanied with any real danger, and we shall certainly never regret that our courage was equal to the task of one good look into such an awful abyss.

Large trees, two hundred feet high, are dwarfed to utter insignificance. The little checker-board like spot first noticed is Lamon's apple orchard of four acres and which contains over five hundred trees, each of which are twenty feet apart. The other cultivated point beyond, formed by

the junction of Tenieya Creek with the Merced River, is Lamon's other orchard, and fruit and vegetable garden. The bright speck which throws out its silvery sheen in that deep tree-dotted canvon is Mirror Lake.

Superb South Dome.

While the South Dome, apparently forever omnipresent in any scene near or within the valley, overshadows and eclipses every lesser wonder by monopolizing a large share of our admiration and attention. Elsewhere, the North Dome, Cloud's Rest, Cap of Liberty, Mount Starr King, Yosemite, and other prominent objects here visible, would have their due effect; but, although at this altitude and position they differ altogether in outline and conformation, the South Dome stands, pre-eminently, king over all.

On the right of this "monarch," in the deep gorge of the river, the magnificent Nevada Fall, Diamond Flume and Apron, Vernal Fall, and the foaming cataract of the Merced, all flash out their silvery sheen most gloriously, while mountains piled on mountains in every conceivable shape, stand guard on every side. But to see these, and other points, to advantage, let us ascend the now easily reached Sentinel Dome.

Had this lofty dome been "scalped" by some tornado it could have scarcely shown less vegetation; for, with the exception of one or two stunted or deformed storm-beaten pines, whose solitary and exposed condition excite our sympathy, there is scarcely a vestige of a living thing upon it; but almost every failing has some virtue to counterbalance it, and often among the meanest of men. It is thus with this point; for if it has no trees to clothe and to beautify, it certainly has none to obstruct or circumscribe the limit of our vision.

Before us lies the very backbone—so to speak—of the Sierra Nevadas; and, although some thirty miles distant, and every prominent peak distinctly visible for fifty miles, it seems almost near enough for us to stretch our hands and touch it. Its vertebræ, however, besides being very uneven, has altitudes upon it exceeding thirteen thousand feet above the sea; and in its sheltered hollows immense banks of snow are eternally sleeping.

Notable Mountains.

The following are some of the most noteworthy mountains seen from this standpoint: Mt. Hoffman, 10,872 feet high; Cathedral Peak, 11,000; Mt. Dana, 13,227; Mt. Lyell, 12,270; Castle Peak, 12,500; Gothic Peak, 10,850; Mount Starr King, 9600; South Dome, 10,000 feet. There are numerous others visible which, although both high and prominent, are as yet nameless.

Did time permit us we might profitably tarry here for hours, or even days, as new beauties would be opening, and strange forms made manifest on every side. Before leaving, however, let us look once more down into the valley, as the haze-draped vertical walls of Tu-tock-ah-nu-lah can be seen from base to summit. The Yosemite, too, with the country above it through which it runs, before making its wonderful leap—its bare ridges, singular groups of rocks, forest-clothed heads of ravines, up to its source at Mount Hoffman, are all spread beneath

us—for, remember, we are over one thousand feet above the Yosemite Fall.

Stretching far away to the west we can look upon the broad valleys of the San Joaquin and Sacramento, and distinctly see the Coast Range near the Golden Gate. But, the rapidly declining sun admonishes us to return; so, let us not tempt the danger that will lurk in our path, if we have to descend any portion of the way in the dark.

Wonderful Sights.

How many days—or weeks, or even months—could be well spent in Yosemite it would be difficult to determine. Hurried visits like those we are making only give glimpses and foretastes of a few of its wonderful sights. Quiet, rest-giving rides, with intervals of physical toil, should give us all time to feel as well as to see, its infinite glories, and beauties, and wonders.

As yet our feet have not trod the tops of such mountains as Tu-tock-ah-nu-lah (El Capitan), Pom-pom-pa-sus (Three Brothers), North Dome and Mount Hoffman, on the north side of the valley; while on the south side there would be the fissure, one thousand feet deep, the Clouds' Rest, and others equally worthy. But in order to see all of such points to advantage, and with real enjoyment, camping-out parties should be organized, properly provided with suitable outfits and servants, and the "round trip" be made from Tamarack Flat to Tuolumne Valley, by Cathedral Valley and Lake Tenieya; and returning by the Mountain Meadows on the Mariposa side.

The time will come when such glorious scenes as could be witnessed on such an excursion will be one of the great charms in visiting Yosemite. The health-giving properties of such a journey, too, would, in untold instances, renew the apparently short lease of life vouchsafed to many. The comfortably bracing atmosphere and the pure, delicious water, united with the sublime scenery, would be the magical genii of their cure.

Charles Brace, in his valuable work, "The New West," thus graphically writes:

"From this hotel (the Yosemite) there are excursions enough to occupy one for weeks among the beautiful scenes of the valley. Each morning the guide saddles the horses—which had been turned loose in the mountain pasture—and fastens them in front of the house; and, after lunch has been packed, we set off in different directions to see the famous points and objects. One of the most enjoyable features of the excursion is simply cantering up and down the valley, getting the new aspects which open freshly every half mile and are different every hour of the day. There is a grand and changing scene at almost every step.

Delightful Atmosphere.

"The wonderful thing about the canyon, which will hereafter draw many an invalid here from distant lands, is its divine atmosphere. To me, just recovering from a tedious fever, it seemed the very elixir of life—cool, clear, stimulating, and filled with light and glory from the sun of the South, which here never seems in summer to have a cloud. The nights are cool, but mid-day would be too warm were it not for the delicious sea breeze which every day at eleven blows in from the

Golden Gate, a hundred and fifty miles away, where one is well repaid for the visit made.

"The gorge is fortunately east and west, just about opposite to San Francisco, and about midway between the two flanks of the Sierras—here some seventy miles in width. Were it a north and south valley, even at its altitude (4,000 feet) it would be almost intolerable. Now, nothing can surpass its mild, invigorating climate and harmonious atmosphere. Life seems to have a new spring and hope under it. The charm of the wonderful valley is its cheerfulness and joy. Even the awe-inspiring grandeur and majesty of its features do not overwhelm the sense of its exquisite beauty, its wonderful delicacy, and color, and life, and joy.

Grandeur and Beauty.

"As I recall those rides in the fresh morning or the dreamy noon, that scene of unequalled grandeur and beauty is forever stamped on my memory, to remain when all other scenes of earth have passed from remembrance—the pearly-gray and purple precipices, awful in mass far above one, with deep shadows on their rugged surfaces, dark lines of gigantic archways or fantastic images drawn clearly upon them, the bright white water dashing over the distant gray tops seen against the dark blue of the unfathomable sky, the heavy shadows over the valley from the mighty peaks, the winding stream and peaceful greensward with gay wild-flowers below, the snowy summits of the Sierras far away, the atmosphere of glory illuminating all, and the eternal voice of many waters wherever you walk or rest. This is the Yosemite in memory

"I have been thinking much of scenes in Norway, Tyrol and Switzerland with which to compare this. Switzerland, as a whole, is much superior in combinations and variety of features to the Sierra region. But there is no one scene in Switzerland, or the other parts of mountainous Europe, which can at all equal this California valley.

Swiss Scenery Outdone.

"The Swiss scene has the advantage in the superb glaciers which flow into the upper end of the valley, but it is inferior in grandeur, and even in life, to the Californian. The latter having immensely grander precipices, and, instead of one waterfall—the Staubbach—a dozen on a much grander scale."

"An English gentlemen, a member of the celebrated Alpine Club, spent seventeen days in Yosemite, and upon leaving he remarked to the writer: 'I never left a place with so much pleasurable regret in my life. I have several times visited all the noted places in Europe, and many that are out of the ordinary tourist's round.

"'I have crossed the Andes in three different places, and been conducted to the sights considered most remarkable—I have been among the charming scenery of the Sandwich Islands and the mountain districts of Australia, but never have I seen so much of sublime grandeur relieved by so much beauty as that which I have witnessed in Yosemite.'"

A love for the beautiful, in nature or in art, is not only a magnet of attraction to persons of kindred tastes, but, dispell-

ing all national prejudices and social ceremonies, becomes a bond of individual friendship between men of different countries, habits and peculiarities. Especially is this remarkable in those who travel much; for, without being offensively obtrusive, they have learned to accept and bestow kindnesses promptly, as matters of natural courtesy; and to ask or answer questions, sometimes in partial anticipation of the wishes and pleasures of a fellow-traveler, without any apparent obligation to or from either, and which places them on terms of intimacy and friendliness to each other.

Alps and Yosemite.

Through such a medium, by the kindness of the Rev. P. V. Veeder, of Napa, we are favored with the following notes of comparison between the scenery of the Yosemite Valley and that of some parts of Switzerland:

"The Alps of Switzerland and Savoy may be compared to a vast shield or buckler lying on the bosom of the earth, and extending one hundred and fifty miles from the borders of France to the Alps of the Tyrol, and one hundred miles from the plains of Piedmont tothe broad valley between the Alps and the Jura Mountains.

"From this rough-seamed surface, there rise three immense bosses, or projecting points—three radiating centres, sending off lofty chains of mountains towards each other, and into the plains of France, Italy and Switzerland at their feet. The loftiest of these bosses or centres is Mont Blanc in Savoy, the height of which is fifteen thousand seven hundred and forty-four feet; the next in height is Monte Rosa, fifteen thousand two hundred feet high; and the third is the Bernese Alps, the culminating point of which is the Finster-Aahorn, fourteen thousand one hundred feet high.

Vast Mountain Masses.

"These three grand centres are about sixty miles apart, and each has a scenery peculiar to itself. They are like vast rugged mountain masses, towering six thousand feet into the region of perpetual snow; but Mont Blanc has its 'aiguilles' or needles; Monte Rosa, its wonderful neighbor, Mont Cervin; and the Bernese Alps have their beautiful valley of misty waterfalls, leaping over perpendicular cliffs. The traveler who visits Yosemite Valley after seeing the Alps, will be reminded of each of these three grand centres.

"He will see the aiguilles of Mont Blanc in the 'Sentinel,' or 'Castle Rock,' rising as straight as a needle, to the height of three thousand two hundred feet above the valley, and in several other pointed rocks of the same kind. He will be reminded of the sublimest object in the vicinity of Monte Rosa, the Matterhorn, or Mont Cervin, the summit of which is a dark obelisk of porphyry, rising, from a sea of snow, to the height of four thousand five hundred feet. 'The South Dome,' at Yosemite Falls, is a similar obelisk, four thousand five hundred and ninety-three feet in height.

"But above all, the general shape, the size and the water-falls of Yosemite Valley give it the closest resemblance to the famous valley of Lauterbrunnen, at the base of the Jungfrau, in the Bernese Alps. No part of Switzerland is more admired and visited. To me, its chief charm is

not so much its sublime precipices and its lofty waterfalls, which give the valley its name, 'Lauterbrunnen,' meaning 'sound-ign-brooks,' as the magnificent mountain summits, towering up beyond the precipices, and the unearthly beauty and purity of the glistening snows on the bosom of the Jungfrau, and the mountains at the head of the valley.

Splendid Waterfalls.

"But these summits are not the peculiar characteristic features of Lauterbrunnen Valley. These are the waterfalls, the perpendicular precipices and the beautiful grassy and vine-clad vale between. And these are the grand features of Yo-Semite Valley. Here you stand in a level valley of about the same dimensions as the Lauterbrunnen—from eight to ten miles long, and a little more than a mile wide—covered here with a magnificent pine forest, the trees averaging two hundred feet in height; there, with a growth of noble oaks; and elsewhere opening into broad grassy fields. These natural features almost equal in beauty the vineyards, gardens, and cultivated fields of Lauterbrunnen.

"But look, now, at the waterfalls: only one of them in the Swiss valley has a European celebrity—the Staubbach, or 'Dust-Brook'—known as the highest cascade, in Europe. It falls at one leap, nine hundred and twenty-five feet. Long before it reaches the ground it becomes a veil of vapor, beclouding acres of fertile soil at its foot. It is worthy of all the admiration and enthusiasm it excites in the beholder. But the 'Bridal Veil' (Pohono) Fall in Yosemite Valley is higher, being nine hundred and forty feet in altitude; leaps out of a smoother channel, in a clear, symmetrical arch of indescribable beauty; has a larger body of water, and is surrounded by far loftier and grander precipices.

"When we come to the 'Yosemite Falls' proper, we behold an object which has no parallel anywhere in the Alps. The upper part is the highest waterfall in the world, as yet discovered, being fifteen hundred feet in height. It reminds me of nothing in the Alps but the avalanches seen falling at intervals down the precipices of the Jungfrau. It is, indeed, a perpetual avalanche of water comminuted as finely as snow, and spreading, as it descends, into a transparent veil, like the train of the great comet of 1858.

A Snowy Comet.

"As you look at it from the valley beneath, a thousand feet below, it is not unlike a snowy comet, perpetually climbing, not the heavens, but the glorious cliffs, which tower up three thousand feet into the zenith above, not unlike a firmament of rock.

"The lower section of the Yosemite Falls has its parallel in Switzerland, the Handeck, but is much higher. The scenery around the 'Vernal' (Pi-wy-ack) Falls—which resembles a section of the American Falls at Niagara—is like that of the Devil's Bridge, in the great St. Gothard road, which is, perhaps, the wildest and most savage spot in Switzerland, unless we except that wonderful gorge of the Rhine—the Videllala.

"But when you climb through blinding spray, and up 'The Ladders,' to the top of the Vernal Falls, and follow the foaming river to the foot of the 'Nevada'

(Yo-wi-ye) Falls, all comparison fails to convey the remotest idea of the wildness and sublimity of the scene. The Swiss traveler must climb the rugged sides of Mont Blanc, cross the Mer de Glace, and, stationing himself on the broken rocks of the Gardin, imagine a river falling in a snowy avalanche over the shoulder of one of the sharp aiguilles, or needle-shaped peaks around him. There are no glaciers at the foot of the Nevada Falls, but every other feature of the scene has an unearthly wildness, to be equaled only near Alpine summits.

Dizzy Precipices.

"To return again to the comparison of the sister valleys—the Yosemite and the Lauterbrunnen. The third peculiar feature of the Swiss valley is the parallel precipices on each side, rising perpendicularly from one thousand to fifteen hundred feet. They are, indeed, sublime, and where the cliff projects, in a rounded form, like the bastions of some huge castle, you might imagine that you beheld one of the strongholds of the fabled Titans of old.

"But what are they, compared with such a giant as Tu-tock-ah-nu-lah, lifting up his square granite forehead, three thousand and ninety feet above the grassy plain at his feet, a rounded, curving cliff, as smooth, as symmetrical to the eye, and absolutely as vertical, for the upper fifteen hundred feet, as any Corinthian pillar on earth! What shall we say, when, standing in the middle of a valley more than a mile wide, you know that if these granite walls should fall toward each other, they would smite their foreheads together hundreds of feet above the valley! What magnificent domes are those, scarcely a mile apart—the one three thousand eight hundred feet, and the other four thousand five hundred and ninety-three feet in height!

Snow-Capped Mountains.

"When you stand in the valley of Lauterbrunnen and look at the snowy summit of Jungfrau, or 'Virgin,' you behold an object eleven thousand feet above you; but your map will tell you that it is five miles distant, and, by a little calculation, you will find that you raise your eyes at an angle of only twenty-three degrees. So at Chamounix, you look up at the snowy dome of Mont Blanc, rising twelve thousand three hundred and thirty feet above you; but you must remember that it is six and one-half miles distant from you, and the angle at which you view it is only twenty degrees; while the very sharpest angle at which you can view it is twenty-five degrees.

"But at Yosemite you need but climb a few rods up the rocks at the base of that granite wall, and, leaning up against it, you may look up—if your nerves are steady enough to withstand the impression that the cliffs are falling over upon you—and see the summits above you, at an angle of nearly ninety degrees; in other words, you will behold a mountain top three thousand feet above you in the zenith. I have seen the stupendous declivity of the Italian side of Monte Rosa—a steep, continuous precipice of nine thousand feet; but it is nothing like Tu-tock-ah-nu-lah, being nowhere absolutely perpendicular. The advantages in many respects are decidedly in favor of our American scenery."

DEPARTMENTS AT WASHINGTON

How Our Country is Governed—Topical Outline of United States Government.

THE EXECUTIVE DEPARTMENT.

The President.

How Elected.—The several steps in the election of the President are:

State Electors are chosen at a General Election held on the Tuesday following the first Monday of November of every fourth year; the number of Electors of each State being equal to the number of Senators and Representatives to which the State is entitled in Congress.

The Electors meet in their respective States on the second Monday in January, following their election, and vote by ballot for President and Vice President; and at the same time make certificates of their vote and transmit the same to the President of the Senate.

The Senate and House of Representatives meet together on the second Wednesday of February next ensuing, and count the votes of the State Electors, when, if there is an election, the President of the Senate declares who is elected President and Vice President.

In case there is no choice by the State Electors, the President is elected by the House of Representatives from the three candidates who received the most electoral votes for President; in which election the vote is taken by States, each State having but one vote, and a majority of all the States being necessary to a choice.

Term of Office.—Four years.

Eligibility.—A natural born citizen; resident of the United States fourteen years; minimum age, thirty-five years.

Salary.—Fixed by law at $50,000 per year.

Powers and duties of the President:

Commander-in-Chief of the Army and Navy.

Communicates with Congress by message.

Approves or disapproves Acts of Congress.

Makes treaties with advice and consent of the Senate.

Appoints Public Officers with the advice and consent of the Senate.

Commissions Public Officers of the United States.

Grants reprieves and pardons for offenses against the United States.

The Vice President:

Elected by State Electors the same as the President; or

By the Senate, in case there is no choice by the State Electors.

Term of Office.—Same as for the President.

Eligibility.—Same as required of the President.

Salary.—Fixed by law at $8000 per year.

The Presidential Succession.—In case of the removal, death, resignation, or inability

Of the President, the Vice President takes the President's place.

Of both President and Vice President the heads of the Executive Departments succeed the Presidency in the order in which the Executive Departments are named below: but such officer must be constitutionally eligible to the Presidency, and not under impeachment.

The Executive Departments.

Department of State.—Has charge of foreign affairs.

Treasury Department.—Has charge of fiscal affairs.

Department of War.—Has charge of the Army and military affairs.

Department of Justice.—Has charge of the legal affairs of the Government.

Post Office Department.—Has charge of postal affairs.

Navy Department.—Has charge of Navy and naval affairs.

Department of the Interior.—Has charge of domestic affairs, including public lands, pensions, patents, Bureau of Education, etc.

Department of Agriculture.—Has charge of agricultural affairs, including Weather Bureau, etc.

The Cabinet.

Composed of the Heads of the Executive Departments.

Appointed by the President with the advice and consent of the Senate.

Salary.—Fixed by law at $8000 per year for each member of the Cabinet.

The President and Legislation.

Acts of Congress become laws;

When signed (approved) by the President; or,

By his failure to make objections in writing (veto) within ten days after any act is submitted to him, unless Congress by adjournment within that time prevents its return; but

Congress has power to pass a law over the President's veto by a two-thirds of each House.

THE JUDICIAL DEPARTMENT.

Judges United States Courts.

Appointed by the President with the advice and consent of the Senate.

Tenure of Office.—During life or good behavior; but may retire on full salary after reaching the age of seventy years and after ten years' service on the bench.

Removable.—By impeachment before and conviction by the Senate.

Supreme Court of the United States.

Members.—A Chief Justice and eight Associate Justices.

Salaries.—Chief Justice, $10,500; Associate Justices, each $10,000.

Terms of Court.—One each year, beginning on the second Monday in October.

Original Jurisdiction:

In all cases affecting Ambassadors, Ministers and Consuls.

In all cases in which a State is a party.

Appellate Jurisdiction.—In cases of law and equity where the Inferior Courts have original jurisdiction, with such exceptions and regulations as Congress has made.

The Chief Justice.—Presides over the Senate when it sits as a Court of Impeachment for the trial of the President.

Inferior Courts.

Jurisdiction:

In cases between citizens of different States.

In cases in which the United States is a party.

In cases of admiralty and maritime jurisdiction.

In trials for crimes against the United States; but the trial of crimes must be by jury, and must be held in the State where the crime was committed.

Appeals to the Supreme Court may be had in all cases in law and equity, with such exceptions and regulations as Congress has made.

Kinds of Inferior Courts:

United States Circuit Court of Appeals:

Organized in 1891 to relieve the United States Supreme Court in appellate cases.

Number.—One in each Judicial Circuit.

Members.—Three judges selected from the Circuit or District Courts.

United States Circuit Courts:

Number of Circuits.—Nine.

Number of Judges.—Each Circuit has three Circuit Judges, except two, which have two Circuit Judges each. A Justice of the Supreme Court is also assigned to each Circuit.

Salary of Circuit Judges.—Fixed by law at $6000 per year.

United States District Courts:

Number of Districts.—One or more in each State. At present (1901) there are seventy-six Judicial Districts.

Salary of District Judge.—Fixed by law at $5000 per year.

United States Court of Claims:

Jurisdiction.—Claims against the United States including all claims which may be referred to it by Congress.

Members.—One Chief Justice and four Associate Justices.

Salaries.—Fixed by law at $5000 per year.

In addition to the above-named Courts, Congress has established courts of local jurisdiction in District of Columbia and in the several Territories of the United States, viz.:

Supreme Court of the District of Columbia.—One Chief Justice and five Associate Judges.

Court of Appeals of the District of Columbia.—One Chief Justice and three Associate Justices.

United States Courts in Organized Territories.—One Chief Justice and one or more Associate Judges appointed by the President for four years.

United States Court in Indian Territory.—Consisting of four Judges, one for each Judicial District.

United States Courts (Special) in Hawaii and Porto Rico.

The judicial department of our government has always been adorned with eminent jurists and lawyers. It has been the object of universal admiration.

THE LEGISLATIVE DEPARTMENT.

The Senate.

Number—Two Senators from each State.

Elected.—By the State Legislatures.

Term.—Six years; one-third of the Senate being elected every two years.

Eligibility.—Citizens of the United States nine years; resident of the State; minimum age, thirty years.

Salary.—Fixed by law at $5000 per year.

President of the Senate.—The Vice-President. A Senator elected pro tempore.

Powers of the Senate:

Confirms or rejects nominations of the President.

Ratifies or rejects treaties with Foreign Powers.

Elects President pro tempore of the Senate, and its other officers.

Elects Vice-President of the United States if regular election fails.

Acts as a Court for the Trial of Impeachments.

House of Representatives.

Number.—Three hundred and fifty-seven members, according to the present apportionment.

The next Congress elected will have three hundred and eighty six members.

Elected.—By the voters of the Congressional Districts.

Term.—Two years; the entire House being elected every two years.

Eligibility.—Citizens of the United States seven years; resident of the State; minimum age, twenty-five years.

Salary.—Fixed by law at $5000 per year: the Speaker, $8000 per year.

Powers of the House of Representatives:

Elects its Speaker (presiding officer) and its other officers.

Elects President of the United States if the regular election fails.

Prosecutes Impeachments before the Senate.

Originates all bills for raising revenue.

Congress.

Duration.—The term of each Congress is for two years, commencing March 4th of the odd years.

Regular Sessions.—Annual, beginning the first Monday in December.

Special Sessions.—At the call of the President.

Membership.—Each House is the judge of the election and qualifications of its own members.

Congress has general powers of legislation:

To provide for the raising and disbursement of revenue.

To borrow money; to coin money and to regulate its value; and to fix the standard of weights and measures.

To regulate foreign and interstate commerce.

To declare war, and to maintain an army and navy.

To establish post offices and post roads.

To enact patent and copyright laws.

To enact uniform naturalization and bankruptcy laws.

To provide for the punishment of crimes against the United States.

To establish courts inferior to the Supreme Court.

To provide for organizing and calling out the militia.

To admit new States into the Union.

To provide for the government of the Territories.

To exercise exclusive jurisdiction over the District of Columbia, public lands, public buildings, forts and navy yards.

To enact all laws necessary and proper for carrying into execution all the powers vested by the Constitution in administering the government of the United States.

FORETELLING THE WEATHER

OUR weather bureau was established in 1870. Such organizations are maintained at the public expense in Great Britain, France, Germany, Italy, Australia, Russia, India, Algeria and Japan. Several smaller countries share in the expense and benefits. Men long trained in the work grow more reliable. Each must first master the topography and the prevailing movements of the atmosphere of any region ere he can presume to know anything of the probable changes.

How extremely important a knowledge of the country is will be understood when it is remembered that mountain ranges may turn aside great storms and hills of any considerable size may modify small ones. And in general storm paths are so narrow in comparison with the whole country that the slightest variation at the start may be very important at the end of six hundred or seven hundred miles or a day's travel.

So, announcing twenty-four hours beforehand the exact locality a storm may reach, is really a very delicate piece of work. If a tyro should announce rain for North Georgia he might be astonished to find a difference of 21 per cent. between Atlanta and Augusta. He would find in Tennessee 16 per cent. difference between Knoxville and Nashville, or 12½ per cent. in Iowa between Dubuque and Davenport.

The Signal Service does not endeavor to forecast entirely new conditions so much as to give warning of storms already on the way. It can not safely say where a storm will arise, but it can declare with tolerable certainty the path a storm will pursue after having once started.

Yet there are certain signs of rain that can be of use to the public. Americans, as a rule, pay less attention to the actions of the animal kingdom at change of weather than other nations, and the lower animals detect changes of weather more quickly than man. Slugs and snails often leave their crannies and endeavor to find some drier retreat at the approach of rain. Swallows fly lower, chiefly because the

insects they pursue abandon the upper air. Crickets and grasshoppers become less noisy and seek snug retreats. Fish leap more frequently from the water. The oft-praised tree frog seems not to have deserved the confidence placed in him as a barometer.

Spiders as Weather Prophets.

Quatremere Disjonval, when made a prisoner of war by the Dutch, made a careful study of the habits of the house spider while in confinement. His observations played an important part in the war. "General Pichegru, being prevented by the mild weather from carrying out his intention of invading that country, was about to retire with his army from the Dutch frontier when Disjonval found means to inform him that from the signs he had observed in his spiders a severe frost was sure to take place in the next ten days. Pichegru trusted to the prognostic—the frost came in time. Holland was conquered and Disjonval released from his prison."

Voigt asserts that the spider is so reliable a barometer because of its anatomy, the long, slender, unmailed legs being peculiarly sensitive to atmospheric changes. That is when Madam Spider finds herself with a touch of rheumatism she wraps herself in a thicker blanket and takes to her den. In fine weather the garden spiders are much more plentiful, and the tiny gossamer spiders also are numerous and fly at greater heights.

These serve to illustrate the class of phenomena most relied upon by those in every land who must spend much time in the open air. The scientist may understand the laws of winds and rains, but the farmer, the shepherd, the fisherman and sailor, to whom every phase of the weather means much, can, relying upon the actions of the lower animals, detect approaching changes as readily in many cases as the Signal Service, and far more readily or correctly than the *quasi* learned theorist whose stock in trade is a hobby and an unlimited quantity of assumption.

It is one thing to understand law; it is quite another to be able to make practical application of it. Franklin identified lightning with electricity; a century passed before practical use of the electric light resulted. We know now the general laws of air currents, but little application of them has been made.

Regulating the Rainfall.

As to the possibility of controlling the winds no one has thus far had the temerity to propose it; but that rainfall can be partially controlled is well known. The heaviest rains occur in forest areas, and, in turn, the matted roots of the forest and jungle retard the descent of the rain into the water courses and hinder the washing away of the soil. Floods have become more sudden and destructive in the lumber regions since the timber has been cut away, while the actual rainfall is not so great. So a number of our Western States require a "homesteader" to plant a tree claim.

A bold genius has recently asserted that we may produce rain at will by sending up balloons loaded with dynamite or other powerful explosives and then firing them. It has been observed that almost every great modern battle has been followed by a heavy rainfall, and the idea is that the continued explosions have had

much to do with them. Frequenters of Fourth of July picnics will readily vouch for the correctness of the theory.

Doubtless a more effective plan would be simply to apply the well known first principle of air currents and storms—heated air; but this would be immensely expensive. Every year sees exemplifications of it, however, in the heavy rains that follow the great forest fires or prairie fires of our own land. Natives of tropical regions frequently burn the jungle at the close of the dry season, and the unusual heating of large areas in this way doubtless has much to do with hastening the advent of rain.

The expedient of firing the sawgrass ponds is frequently resorted to in Florida, and has been brought to the notice of the public in official meteorolgical reports. It is directly in accordance with the principle of restoration of the balance of forces whereby a long heated term is followed by unusually heavy rains.

OUR AMERICAN NAVY

By Rear Admiral George W. Melville.

AT the beginning of a new century, when every patriotic American naturally dwells upon the achievements and progress of his country, it is especially appropriate to note the present highly efficient state of the navy—the nation's mainstay and preserver of the seas.

Our modern navy is the product of scientific progress and engineering and manufacturing development, to all of which American genius and invention have contributed no small share.

The growth of our naval force during the closing quarter of the century has been exceptionally marked and a just cause for national support and pride. It has nobly and successfully competed with the advance of the most powerful foreign navies—ever closely pressing the leaders, and more than once showing the lead—until to-day, with the exception of the number and tonnage of ships, it stands the equal of any fleet that steams the seas.

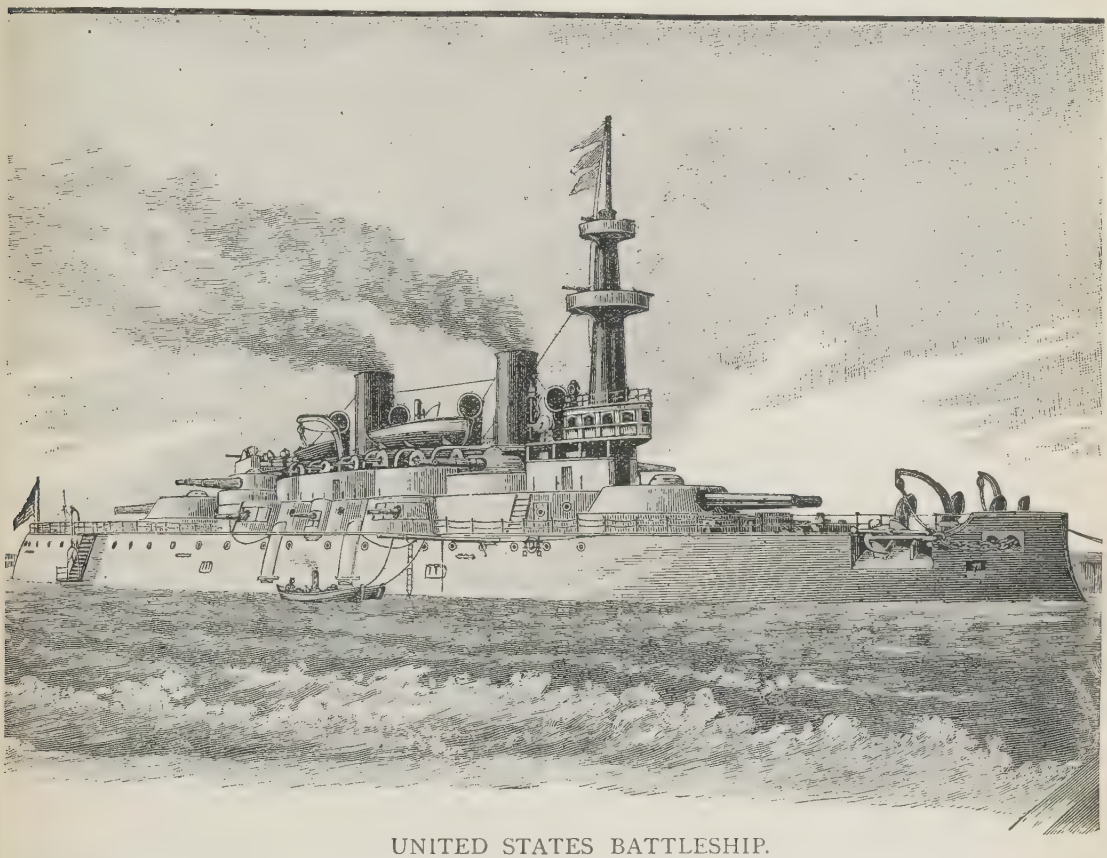
The fact that native material, wrought by our own artisans and mechanics, has been used in the construction of our warships, and the further fact that much of the fighting efficiency of a modern navy being correct in theory only, the special claims for our vessels have been substantiated so far as possible by the outcome of the puny Spanish-American war, is proof positive of America's industrial and naval greatness.

From a stage where the materials and forces used in the hull, machinery and ordnance of our ships were crude and undeveloped there has been evolved, through invention, scientific advance and improved methods of manufacture, the warship of to-day—the epitome of engineering skill and knowledge. From sailing craft of comparative simplicity have

grown "fighting machines" of wonderful complexity.

A modern warship, while not without her weakness—among which may be mentioned the danger that besets her when, through inadvertence, taking the bottom, as well as the possibility of her becoming as motionless as a "painted ship" through lack of fuel—yet possesses in all the cardinal elements of her design advantages which make her infinitely superior to the other types.

With nigh complete immunity from destruction by wind and wave; a marvelous speed and the ability to maintain it in rough weather, and a force, range and rapidity of gun fire is almost incredible, she is rightly the "terror of the seas." Protected by her coat of mail, she is enabled to lead a charmed life amid a storm of "iron rain and leaden hail" that would completely destroy a whole fleet of unarmored vessels.



UNITED STATES BATTLESHIP.

The myraids of distinct and separate mechanisms and the host of mechanical craftsmen aboard the battleship testify, as no words can, to the sweeping changes which the introduction of steam and coordinate forces have wrought.

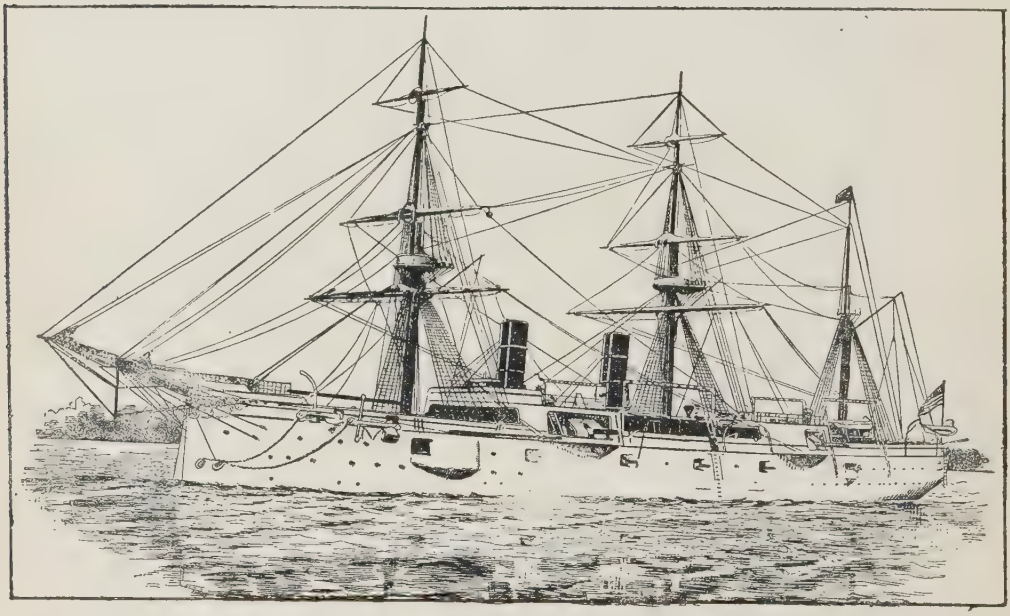
Besides possessing unflinching valor and ability to control and direct his fighting force, to sustain his flag and protect

his country, the naval officer of to-day must master many arts and sciences of which his gallant predecessor was ignorant. When in command he is the controlling spirit of a complex fighting machine, and to properly direct the operation and to supervise the care and preservation of the delicate machinery and monster armament he has to be an engineer.

At present engineering in the navy embodies the application of the latest scientific principle. In every detail of the various plants, shops and huge drydocks at naval stations and in that master creation, the warship itself, the genius and versatility of the engineer are manifest.

The engineering needs of the navy, as of the industrial world, are too complex and manifold to permit of one single man's brain solving the many problems, and the naval specialists (the marine engineer, marine architect, civil engineer and ordnance engineer, all engineers) vie with each other to secure the best results of their individual work when maintaining the highest efficiency of the service as a whole.

That they have done their work worthily and well has been amply shown in the late war with Spain, when, aside from all commendation for gallantry and personal courage, of both officers and men, the acknowledgment of the skilful handling, the great speed, splendid endurance and unerring marksmanship of our vessels was universal.



UNITED STATES CRUISER "CHICAGO."

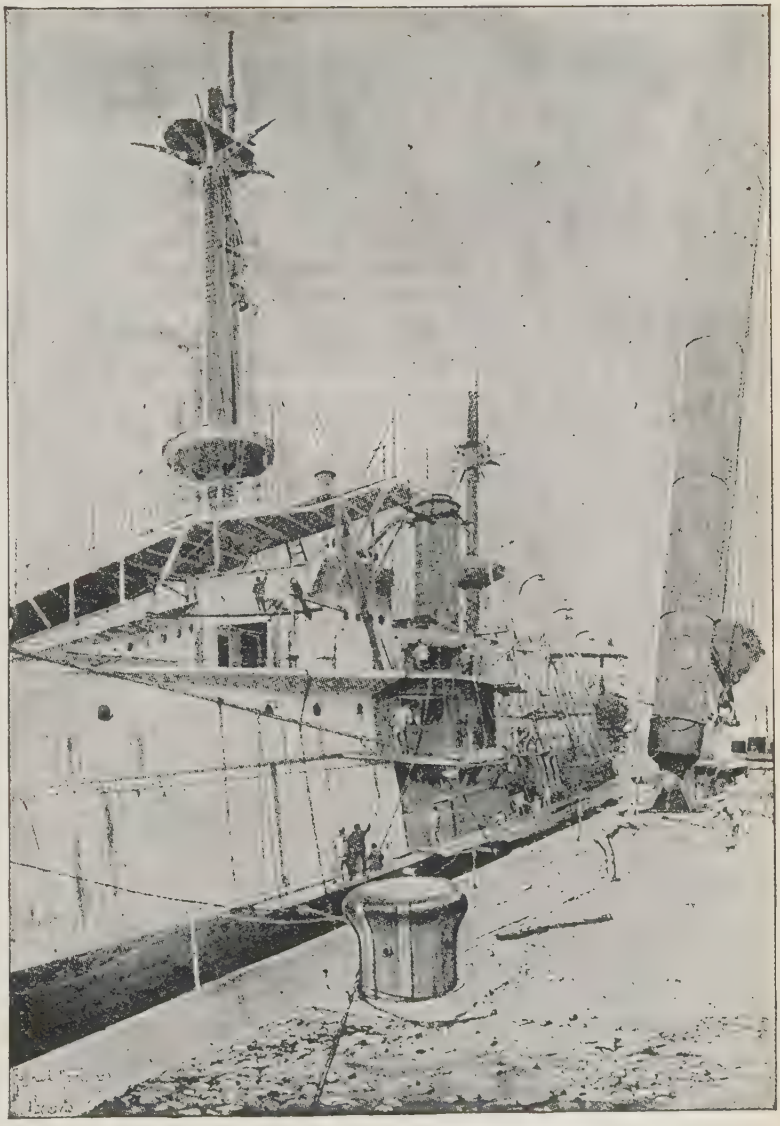
No higher praise can be given the modern navy and naval engineering than to point to the "Oregon"—a ship whose unrivaled record makes a glorious page of American history.

But let us not forget that to the intrepid valor and splendid victories of the old navy—to those gallant spirits who won respect for the flag, a name honored

among honorable nations for their country, and distinction for the service—is largely due the growth and triumph of the new and the augury for its further progress in the twentieth century.

The "Constitution" and the "Oregon" have each in her own age gained imperishable fame, proving the readiness of American resource and genius, as well as giving to the world a shining example of American pluck, indomitable courage, and self-reliance. Their achievements inseparably unite them in the hearts of the people.

The patriots and sages of the Revolution, were they alive to-day, would note with swelling hearts the surpassing of their fondest dreams for their country—its marvellous growth and development, its solidity and prosperity. And, as the dawn of the twentieth century approaches, we should remember in that dark hour of our infant Republic, little more than a hundred years ago, by their life's blood and wise counsels they secured and instituted that which made the development of this country possible —secured the liberty and freedom to pursue, under guidance of wise laws, one's natural bent and tendencies, from which springs the success of the individual, and consequently of the nation.



BUILDING A FIRST-CLASS BATTLESHIP — PLACING THE ARMOR ON THE HULL.

It has been this opportunity to make the most of one's talents, together with a

natural inventive genius, and the possession of those moral traits upon which depend the true advancement of a people, that have given America so wonderful an industrial development. Not only have we kept alive the faith of our fathers and preserved our birthright and inheritance, but have assimilated hundreds of thousands of worthy aliens, and with the aid of their skilled labor have cleared forests, built furnaces, factories and shops that are the bones and sinews of the country.

We have but reaped what our forefathers sowed, and our strength as a nation is the proof of the soundness of their judgment and their natural readiness to adapt themselves to changing conditions and their ability to undertake and complete the most stupendous projects have carried them onward with rapid strides towards mechanical and industrial supremacy, until to-day America is able to compete with older nations in the commercial race and carry forward the gigantic enterprises of the world.

We may well feel confident concerning the position which we shall hold in the twentieth century. The mechanical genius and manifold industries of this country speak well for the solid and sober nature of its people, for since time was the fostering of the mechanic art has gone hand in hand with strength of character and moral development. No greater evidence of the intellectual vigor and liberal-mindedness of Americans can exist than the general recognition in this country of the worthy and important position which the mechanic occupies in the fabric of the State—in this age when engineering, long undervalued, is admitted to be a profession second to none, and when a study of physics is the necessary basis for wise politics.

MOST FAMOUS CATHEDRAL

Within the Mighty Portals of Notre Dame Napoleon Was Crowned Emperor of the French.

ON two occasions only have coronations taken place within the walls of the great Cathedral of Notre Dame, in Paris. One was in 1431, when the little King Henry VI of England, then 11 years of age, was crowned King of France, and the other nearly 400 years later, when, on December 2, 1804, the great Napoleon, reaching the very summit of his proud ambition was crowned Emperor of France.

It was natural, no doubt, that Napoleon should make his coronation a truly imposing and magnificent spectacle. Yet his admirers prefer to think of him as the plain soldier, the hero of the battlefield, rather than as the gorgeously-arrayed sovereign, surrounded by all the pomp of

royalty; an aspect of him we are all familiar with, owing to David's magnificent painting.

Great solemnity and impressiveness was lent to this coronation by the aid of the religious ritual and ceremonies observed. For the first time in the history of the world a Pope was forced to leave his own dominions in order to crown a monarch.

Had to Come From Rome.

Napoleon remembered that Charlemagne had been crowned by Pope Leo, and he determined that he also would be crowned by a Pope; but instead of proceeding to Rome for that purpose, as Charlemagne had done, Napoleon insisted that the Holy Father should come to France. Pope Pius VII was summoned to place the crown on the head of his "dearest son in Christ, Napoleon, Emperor of the French, who has signified his strong desire to be anointed with the holy unction," and the Pontiff, though very reluctantly, felt himself compelled to obey the summons.

The coronation procession through the streets of Paris is said to have been one of the most magnificent ever seen, yet the Parisians who turned out in their thousands to witness it were more amused and delighted with it as a show than deeply impressed with its significance. Even the presence of the Pope himself failed to solemnize them, the sight of the ass which preceded him drawing forth shouts of merriment from the light-hearted Parisians.

Many people in France were ignorant that at Rome, when the Pope went out to officiate at any of the great churches, his chaimberlain rode before him on an ass, carrying a large cross. This custom the chamberlain determined should be carried out in Paris, but as he only spoke of it at the last moment, all the grooms of the Tuileries had to be dispatched in different directions in quest of an ass.

They fortunately found one very soon, and it was hastily caparisoned. The chamberlain, it is said, rode through the crowded streets with the greatest composure and dignity, taking not the slightest notice of the jeers and mockery of the onlookers, who made sport of a sight so grotesque.

Brilliant Spectacle.

The spectacle inside the walls of Notre Dame was a brilliant one. The whole edifice had been newly painted for the occasion, and specially decorated galleries and pews were erected, "filled," as a contemporary writer says, "with the handsomest women whom the best company could produce, and most of whom rivalled in the lustre of their beauty that of the jewels with which they were crowned." An imperial throne was erected, supported by eight pillars, and within this, on an elevated alcove, Napoleon seated himself after his coronation, under a canopy of crimson velvet, ornamented with gold fringe and bespangled with beads.

The Pope did not actually crown Napoleon and Josephine. After lifting the crowns, which lay upon the altar, and blessing them, he replaced them on the same spot, and Napoleon, then coming forward, took up his crown, a simple laurel wreath in gold, and placed it on his own head; he then proceeded to lay

the smaller crown on Josephine's head, as she knelt in front of him in her gorgeous robes to receive it.

Previous to this the Pope had anointed the Emperor and Empress, using the following rather remarkable prayer when applying the unction to the brow of Napoleon: "God all powerful and eternal, Thou who hast established Hazael for Governor of Syria, and Jehu, King of Israel, in manifesting Thy pleasure through the organs of the prophet Elias, who equally anointed with the sacred unction of Kings the brows of Saul and David, by the ministry of Thy prophet Samuel, diffuse through my hands the treasures of Thy grace and benediction on Thy servant Napoleon, whom, notwithstanding our own littleness, we this day consecrate Emperor in Thy name."

SUBLIME METEORIC SHOWER

Dazzling Display All Over the United States—Brilliant Phenomena of the Heavens.

EXTENSIVE and magnificent showers of shooting stars have been known to occur at various places in modern times, but the most universal and wonderful which has ever been recorded is that of the 13th of November, 1883, the whole firmament over all the United States being then, for hours, in fiery commotion. No celestial phenomenon has ever occurred in this country since its first settlement, which was viewed with such intense admiration by one class in the community, or with such dread and alarm by another.

It was the all-engrossing theme of conversation and of scientific disquisition for weeks and months. Indeed, it could not be otherwise, than that such a rare phenomenon—next in grandeur and sublimity to that of a total solar eclipse, or a great comet stretched athwart the starry heavens, in full view of a wonder-struck universe—should awaken the deepest interest among all beholding it. Nor is the memory of this marvelous scene yet extinct; its sublimity and awful beauty still lingers in many minds, who also remember well the terror with which the demonstration was regarded, and the mortal fear excited among the ignorant that the end of the world had come.

During the three hours of its continuance, the day of judgment was believed to be only waiting for sunrise, and, long after the shower had ceased, the morbid and superstitious still were impressed

with the idea that the final day was at least only a week ahead. Impromptu meetings for prayer were held in many places, and many other scenes of religious devotion, or terror, or abandonment of worldly affairs, transpired under the influence of fear occasioned by so sudden and awful a display.

The People Panic-Stricken.

But, though in many districts the mass of the population were thus panic-stricken, through fear, as well as want of familiarity with the history of such appearances, the more enlighted were profoundly awed at contemplating so vivid a picture of the apocalyptic image—that of "the stars of heaven falling to the earth, even as a fig tree casting her untimely figs, when she is shaken of a mighty wind." In describing the effect of this phenomenon upon the black population, a southern planter says:

"I was suddenly awakend by the most distressing cries that ever fell on my ears. Shrieks of horror and cries for mercy could be heard from most of the negroes of three plantations, amounting in all to some six or eight hundred. While earnestly and breathlessly listening for the cause, I heard a faint voice near the door calling my name. I arose, and taking my sword, stood at the door. At this moment I heard the same voice still beseeching me to rise, and saying, 'O, my God, the world is on fire!' I then opened the door, and it is difficult to say which excited me most—the awfulness of the scene, or the distressed cries of the negroes. Upwards of one hundred lay prostrate on the ground, some speechless, and others uttering the bitterest moans, but with their hands raised, imploring God to save the world and them. The scene was truly awful, for never did rain fall much thicker than the meteors fell towards the earth; east, west, north and south, it was the same. In a word, the whole heavens seemed in motion."

The display, as described in Professor Silliman's Journal, was seen all over North America. The chief scene of the exhibition was within the limits of the longitude of sixty-one degrees in the Atlantic Ocean and that of one hundred degrees in Central Mexico and from the North American lakes to the southern side of the island of Jamaica.

Surpassingly Grand.

Over this vast area an appearance presented itself far surpassing in grandeur and magnificence the loftiest reach of the human imagination. From two o'clock until broad daylight, the sky being perfectly serene and cloudless, an incessant play of dazzlingly brilliant luminosities was kept up in the whole heavens. Some of these were of great magnitude and most peculiar form. One, of large size, remained for some time almost stationary in the zenith over the Falls of Niagara, emitting streams of light which radiated in all directions. The wild dash of the waters, as contrasted with the fiery commotion above them, formed a scene of unequal and amazing sublimity. Arago computes that not less than two hundred and forty thousand meteors were at the same time visible above the horizon of Boston! To form some idea of such a spectacle, one must imagine a constant succession of fire-balls resembling sky-rockets radiating in all directions from a

point in the heavens near the zenith and following the arch of the sky towards the horizon. They proceeded to various distances from the radiating point, leaving after them a vivid streak of light, and usually exploding before they disappeared. The balls were of various sizes and degress of splendor; some were mere points, but others were larger and brighter than Jupiter or Venus, and one in particular appeared to be nearly of the moon's size. But at Niagara no spectacle so terribly grand and sublime was ever before beheld by man as that of the firmament descending in fiery torrents over the dark and roaring cataract!

Celestial Fireworks.

Everywhere within the range of the exhibition the first appearance was that of fireworks of the most imposing grandeur, covering the entire vault of heaven with myriads of fire-balls resembling sky-rockets. On more attentive inspection it was seen that the meteors exhibited three distinct varieties, as follows, described by Dr. Olmsted:

First, those consisting of phosphoric lines, apparently described by a point. This variety was the most numerous, everywhere filling the atmosphere and resembling a shower of fiery snow driven with inconceivable velocity to the north of west and transfixing the beholder with wondering awe.

Second, those consisting of large fire-balls, which at intervals darted along the sky, leaving luminous trains which occasionally remained in view for a number of minutes, and, in some cases, for half an hour or more. This kind appeared more like falling stars, giving to many persons the very natural impression that the stars were actually falling from the sky, and it was principally this spectacle which caused such amazement and terror among the unenlightened classes.

Third, those undefined luminous bodies which remained nearly stationary in the heavens for a considerable period of time; these were of various size and form.

As if Shot From a Battery.

One of the most remarkable circumstances attending this display was that the meteors all seemed to emanate from one and the same point—that is, if their lines of direction had been continued backward they would have met in the same point, southeast a little from the zenith. They set out at different distances from this point, and, following the arch of the sky, ran along the vault with immense velocity, describing in some instances an arc of thirty or forty degrees in less than four seconds. The trains which they left were commonly white, but were sometimes tinged with various prismatic colors.

One ball—seen at New Haven, and supposed to have been identical with one described by various observers—that shot off in the northwest direction, and exploded a little northward of the star Capella, left, just behind the place of explosion, a phosphorescent train of peculiar beauty. The line of direction was at first nearly straight; but it soon began to contract in length, to dilate in breadth, and to assume the figure of a serpent drawing himself up, until it appeared like a small luminous cloud of vapor. This cloud was borne eastward—the wind blowing gently in that direction—opposite to the course in which the meteor had

proceeded, remaining in sight several minutes.

Of the third variety of meteors, the following are remarkable examples. At Poland, Ohio, a luminous body was distinctly visible in the northeast for more than an hour; it was very brilliant, in the form of a pruning hook, and apparently twenty feet long and eighteen inches broad; it gradually settled towards the horizon, until it disappeared. At Niagara Falls, a large, luminous body, shaped like a square table, was seen nearly in the zenith, remaining for some time almost stationary, and emitting large streams of light. At Charleston, S. C., a meteor of extraordinary size was seen to course the heavens for a great length of time, and then was heard to explode with the noise of a cannon.

Followed the Stars.

The point from which the meteors seemed to issue, was observed, by those who fixed the position of the display among the stars, to be in the constellation Leo. At New Haven, it appeared in the bend of the "sickle"—a collection of stars in the breast of Leo—a little to the westward of the star Gamma Leonis. By observers at other places remote from each other, it was seen in the same constellation, although in different parts of it. An interesting and important fact, in this connection is, that this radiating point was stationary among the fixed stars—that is, that it did not move along with the earth, in its diurnal revolution eastward, but accompanied the stars in their apparent progress westward.

According to the testimony of by far the greater number of observers, the meteors were, in general, unaccompanied by any very peculiar sound; but, on the other hand, such a sound, proceeding, as was supposed, from the meteors, was said to be distinctly heard by a few observers in various places. These sounds are represented either as a hissing noise, like the rushing of a sky-rocket, or as explosions, like the bursting of the same bodies; and these instances were too numerous to permit the supposition that they were imaginary.

From Heat to Cold.

A remarkable change of weather, from warm to cold, accompanied the meteoric shower, or immediately followed it. In all parts of the United States, this change was remarkable for its suddenness and intensity. In many places, the day preceding had been unusually warm for the season, but, before morning, a severe frost ensued, unparalleled for the time of year. Indeed, the seasons and atmospheric changes exhibited remarkable anomalies long after that period. Thus, in parts of Michigan, so uncommonly mild was the season throughout the latter part of November, and the whole of December, that the Indians made maple sugar during this month, and the contiguous lakes remained unfrozen as late as January third. At the same period, the season in the southwestern states, as far as New Orleans, was uncommonly cold. In most portions of New England, an unusually mild winter was succeeded by a remarkably cold and backward spring, requiring domestic fires to be kept thoughout the month of May, and frequently in the month of June. A succession of gales commenced about the time of the meteoric

shower, first in the Atlantic ocean, and afterwards in various parts of the United States, almost unequaled in this country for their frequency and violence.

Burning Substances.

The meteors were constituted of very light, combustible materials. Their combustibility was rendered evident by their exhibiting the actual phenomena of combustion, being consumed, or converted into smoke, with intense light and heat; and the extreme tenuity of the substance composing them is inferred from the fact that they were stopped by the air. Had their quantity of matter been considerable, with so prodigious a velocity, they would have had a sufficient momentum to enable them to reach the earth, and the most disastrous consequences might have ensued. Upon submitting this subject to accurate calculation, upon established principles, Dr. Olmsted ascertained that the quantity of heat extricated from the air by the falling meteors, exceeded that of the hottest furnaces, and could be compared only to those immeasurable degrees of heat produced in the laboratory of the chemist, before which the most refractory substances are melted, and even dissipated in vapor.

Some of the larger meteors must have been bodies of very great size. Dr. Smith, of North Carolina, and other persons in various places, saw a meteor which appeared as large as the full moon. If this body were at the distance of one hundred and ten miles from the observer, it must have had a diameter of one mile; if at a distance of eleven miles, its diameter was five hundred and twenty-eight feet; and if only one mile off, it must have been forty-eight feet in diameter. These considerations leave no doubt that many of the meteors were of great size, though it may be difficult to say precisely how large. The fact that they were stopped by the resistance of the air, proves that their substance was light; still, the quantity of smoke, or residuum, which resulted from their destruction, indicates that there was quite a body of matter.

Amazing Velocity.

The momentum of even light bodies of such size, and in such numbers, traversing the atmosphere with such astonishing velocity, must have produced extensive derangements in the atmospheric equilibrium, as the consideration of certain points will show.

These large bodies were stopped in the atmosphere, only by transferring their motion to columns of air, large volumes of which would be suddenly and violently displaced. Cold air of the upper regions would be brought down to the earth; the portions of air incumbent over districts of country remote from each other, being mutually displaced, would exchange places, the air of the warm latitudes being transferred to colder, and that of cold latitudes to warmer regions; remarkable changes of season would be the consequence, and numerous and violent gales would prevail for a long time, until the atmosphere should have regained its equilibrium. That the state of the weather, and the condition of the seasons that followed the meteoric shower, correspond to these consequences of the disturbance of the atmospheric equilibrium, is a remarkable fact, and favor the opinion early suggested, that such disturbance

is a natural effect of the meteoric shower, and it is a consequence from which the most formidable dangers attending phenomena of this kind are to be apprehended.

Nebulous Matter.

With regard to the nature of the meteors, Dr. Olmsted, after establishing the fact that they were combustible, light, and transparent bodies, infers that the cloud which produced the fiery shower, consisted of nebulous matter, analogous to that which composes the tails of comets. It cannot be said, indeed, precisely what is the constitution of the material of which the latter are composed, but it is known that it is very light, since it meets no appreciable force of attraction on the planets, moving even among the satellites of Jupiter, without disturbing their motions, although its own motions, in such cases, are greatly disturbed, thus proving its materiality; and that it is exceedingly transparent is evinced by the fact that the smallest stars are visible through it. Hence, so far as there can be gathered any knowledge of the material of the nebulous matter of comets, and of the matter composing these November meteors, they appear to be analogous to each other.

Various hypotheses have been proposed to account for this wonderful phenomenon. The agent most readily suggesting itself in this and in most other unexplained natural appearances—electricity—has no known properties adequate to account for the production of the meteors, for the motions which they exhibited, or for the trains, which in many instances, they left behind them. And, if this agent be supposed to have some connection with the light and heat which they exhibited, it is to be borne in mind, that the compression of the air which must result from the rapid progress of large bodies through it, is a sufficient cause of this.

Magnetism has also been assigned as the principal agent concerned in producing the meteoric shower. The aurora borealis, and the remarkable auroral arches which occasionally appear in the sky, have been found to have peculiar relations to the magnetism of the earth, arranging themselves in obedience to the laws of magnetic attraction. Something of this kind was supposed by some to appear during the meteoric phenomenon, especially in the position of the apparent center or radiant point, which was, as noticed by many observers, very nearly in the place towards which the dipping-needle is directed. From other observations, however, it appears that the radiant point was not stationary with respect to the meridian, but accompanied the stars in their westerly progress, the apparent coincidence with the pole of the dipping-needle being, according to this, purely accidental, and not regulated by any law.

Their Mysterious Origin.

According to the view that has been taken by some of the origin of meteoric stones, namely, that of ascribing them to terrestrial comets, the hypothesis has been suggested that the meteors in question might have a similar origin. But the body which afforded the meteoric shower could not have been of the nature of a satellite to the earth, because it remained so long stationary with respect to the earth—at least two hours—a period suffi-

cient to have carried it nearly round the earth in a circular orbit.

Nor can it be supposed that the earth, in its annual progress, came into the vicinity of a nebula, which was either stationary, or wandering lawless through space. Such a collection of matter could not remain stationary within the solar system, in an insulated state; and had it been in motion in any other direction than that in which the earth was moving, it would soon have been separated from the earth, since, during the eight hours while the meteoric shower lasted—and perhaps, in all its wide range, it lasted much longer—the earth moved in its orbit through the space of nearly five hundred and fifty thousand miles.

A Remarkable Light.

In connection with the account of this meteoric shower, mention may be made of a remarkable light, seen in the east at the time of that great display, and subsequently in the west after twilight at different times, until the month of May, which light assumed different aspects, corresponding, apparently, to those which the body revolving around the sun, in the manner contemplated by theory, would occupy. Hence it was conjectured, that this luminous appearance proceeded from the body itself, which afforded the meteoric shower. It has also been suggested that this light may result from the same cause as the zodiacal light, and that the latter interesting phenomenon perhaps results from a nebulous body revolving around the sun, interior to the orbit of the earth.

It is a point worthy of contemplation, namely, the direful effects which such a "fiery shower" might, in the absence of that law of harmony which governs the universe, have unquestionably produced. Had the meteors been constituted of materials a little more dense, their momentum would have enabled them to reach the earth; and had they held on their course three seconds longer, it is impossible to conceive of the calamities which would have ensued by the descent to the earth of bodies of such magnitude, glowing with the most intense heat. Half the continent must have been involved in one common destruction!

Many Great Displays.

One of the most interesting facts pertaining to this grand celestial phenomenon is its periodical character. Between the years 903 and 1833, of the modern era, thirteen of these great showers are recorded, separated from each other by intervals of thirty-three and sixty-six years. It is not a little remarkable, too, that the epoch of these periodic displays coincides with the annual November showers so familiar in their occurrence to all, and that their point of divergence in the heavens is the same. Indeed, the phenomenon of the long interval or period differs from that of the annual period only in its numerical character.

The last of these magnificent stellar showers, second, perhaps, in grandeur of demonstration to that of November, 1833, which latter stands solitary in its unsurpassed extent and splendor, occurred November 14th, 1867, beginning at about three o'clock in the morning. At half-past three a meteor of a greenish blue color and about the size of a star of the first magnitude shot out from the direc-

tion of the constellation Leo, lighting up the sky with a long train of crimson fire and traveling in a northwesterly direction. It had scarcely faded from the sight when another and equally brilliant, though not quite so large, came speeding along in its track, and it was followed by fourteen of smaller magnitude, one by one, in quick succession. At this moment a heavy cloud drifted towards the north, and for some minutes the spectacle was partially lost to view. That the meteors were falling rapidly, however, was plainly evident, for from all points where the mass of clouds was thin occasional meteors flashed out, and the frequent lighting up of the clouds as they passed over left no doubt that the mysterious phenomenon was having full play in the regions beyond.

Their Size and Brilliancy.

At ten minutes before four o'clock the northern sky again became clear; a thick and almost impenetrable cloud passed over the moon, partially obscuring its light, and thus enabling the observers to view with greater distinctness the size and brilliancy of the meteors.

The display was now a most magnificent one, indeed. The meteors shot out from Leo in all directions, and with remarkable swiftness traveled across the horizon. Sixty-three were counted in one minute and ten seconds, of which three were of extraordinary size and beauty. One of these, of a greenish hue, and followed by a long train of the same color, traveled in the direction of Ursa Major, and as it was disappearing in the southern horizon, apparently burst, lighting up the sky for a great distance on all sides. It soon became utterly impossible to keep any correct account of the number falling. Eight, ten and twelve sped onwards, on their erratic course, at the same moment, scarcely disappearing before others of equal splendor took their places. For fully twenty minutes they continued to fall with the same rapidity, during which time there were counted, exclusive of those already mentioned three hundred and thirteen. This number, however, was not one-fifth of that which really fell, as observed in New York City. Not less than fifteen hundred or two thousand were estimated by observers at that city, to have radiated from Leo during this space of time, some of which were splendid in color and movement.

One of Surpassing Beauty.

One of the meteors constituting this display is described as of surpassing beauty, size and brilliancy. It radiated from Leo, and took a direct northerly course toward Ursa Major, followed by a long train of a yellowish red hue, which spanned the horizon from its point of appearance to that of its disappearance. This meteor was of the same greenish blue color as the others which preceded it, and as it passed over about one-half of the course traversed it seemed to burst, and then the spectacle was one of extreme beauty. Apparently, hundreds of fragments of an almost blood-red color broke from it and scattered in every direction, while it continued its course towards the north, no longer wearing its greenish-blue color, but of one uniform and beautiful blue. The panorama it presented was exceedingly grand, and lasted about three minutes, before the varied colors disappeared and the fire-lit skies resumed

their wonted serenity. After the appearance of this the display died away.

Although it is doubtful, from the want of the requisite data, whether the source of the meteors, or the height of the meteoric cloud has been accurately ascertained, yet the truth in regard to the latter may be approximated. According to the established laws of falling bodies, the velocity the meteors would acquire in falling from a point two thousand two hundred and thirty-eight miles above the earth to within fifty miles of its surface—this being considered as nearly the height of the atmosphere—is about four miles per second, which is more than ten times the maximum velocity of a cannon ball, and about nineteen times that of sound.

BIGGEST METEORITE ON RECORD

PROF. HENRY A. WARD, of Chicago, when he returned from a late visit to Mexico, announced the discovery there of the largest meteorite on record. This gigantic messenger from the skies, which is so big, says Prof. Ward, that it would cost $50,000 to bring it to the sea coast, weighs about fifty tons.

The announcement of this discovery has been made by Prof. Ward to the Academy of Sciences at Rochester, where Prof. Ward was formerly a resident. His account before the academy was the first presentation of his discovery to the scientific world. It was the intention of Prof. Ward to prepare a paper fully describing and setting forth this important topic for the society, but as it was not ready he gave instead an informal account.

Prof. Ward, when introduced, stated that he had just returned from a visit to the West Indies, South America, and Mexico, and that while in Mexico he found what he went after—a giant meteorite.

Professor Ward's Account.

"You know how many meteorites have been found in Mexico?" he said. "Why they are so large and of iron formation is what puzzles. Some have said it was due to some special attraction of the minerals in Mexico, but this hardly seems possible to me, owing to the rapidity with which the earth revolves, and if a meteor were attracted to a given point, the velocity of the earth's momentum would throw it far from this point of attraction.

"The same question might come up in regard to the construction of the meteorites, which are all of iron, there having been only two or three of stone found. In Arizona and Kansas the meteors found are all of stone. It is very puzzling. The Mexican government has been very liberal in bringing together these meteorites, which are grouped before a building in the City of Mexico, and handsomely mounted, some $50,000 having been appropriated for this purpose.

"I had heard a rumor of a very large meteorite in the country bordering the Gulf. These rumors were so uncertain that they made a search for it very tempting, so having a month at my disposal I determined to set out and try to settle the question once and for all in regard to the existence of this meteorite."

Search for the Meteorite.

Professor Ward here gave a very interesting account of his expedition in search of the mammoth meteorite. The first thing he did was to hunt up a photographer to accompany him, and this matter gave him some difficulty, since he was afraid he might not find any one in Mexico willing to undertake the expedition. But after finding his man, arrangements were quickly made.

They made the journey, says the "Rochester Democrat and Chronicle," partly by rail, then along the seacoast and the volcanic region, disembarking at Colima and traveling by mule around the volcanic mountain of Colima. He described this volcano as emitting sudden and silent explosions of vapor which rise in the air like a flower. He traveled about ninety-five miles from the coast, and finally found the meteorite about which so many rumors had reached the scientific ear, some declaring it was as large as a ship. It was found in a cultivated cornfield.

Professor Ward engaged some twenty-eight Mexicans to dig it out for him, paying them 75 cents a day, which was double their regular wages. It took them a day and a half to dig around the mass and expose its base. It rested on solid rock, and had not this rock intervened it would have disappeared in the earth, Professor Ward declared. There was absolutely no soil between it and the rock on which it lay. All the surrounding soil had undoubtedly come in since the meteor fell, and if this were so it will carry its fall very far back in the past, the speaker said.

Professor Ward gave the size as 13 feet 1 inch in length, 6 feet 4 inches thick and 5 feet 4 inches wide and the probable weight as fifty tons. The outside was well preserved, the absence of moisture in the atmosphere preventing decomposition. The pittings were finely distributed all over it. There was one large crack.

Had to use Dynamite.

By using small sticks of dynamite Professor Ward was enabled to separate several large specimens of this meteorite, which he declared to be beautiful in formation. The great mass will probably never be removed. He estimated it would cost something like $50,000 to get it to the seaport.

"But the discovery," says Professor Ward, "is an exceedingly valuable one, in settling once and for all the existence of this meteorite, and is of special interest to scientists." It was stated by Professor Dodge, President of the Academy, that Professor Ward possesses the largest collection of meteorites ever gotten together by one individual, though the latter says it ranks fourth in size in the world.

The address of Professor Ward was merely a preliminary statement and the first public presentation of the subject. The mystery concerning these bodies is not so great as it once was, and each year adds something to our knowledge.

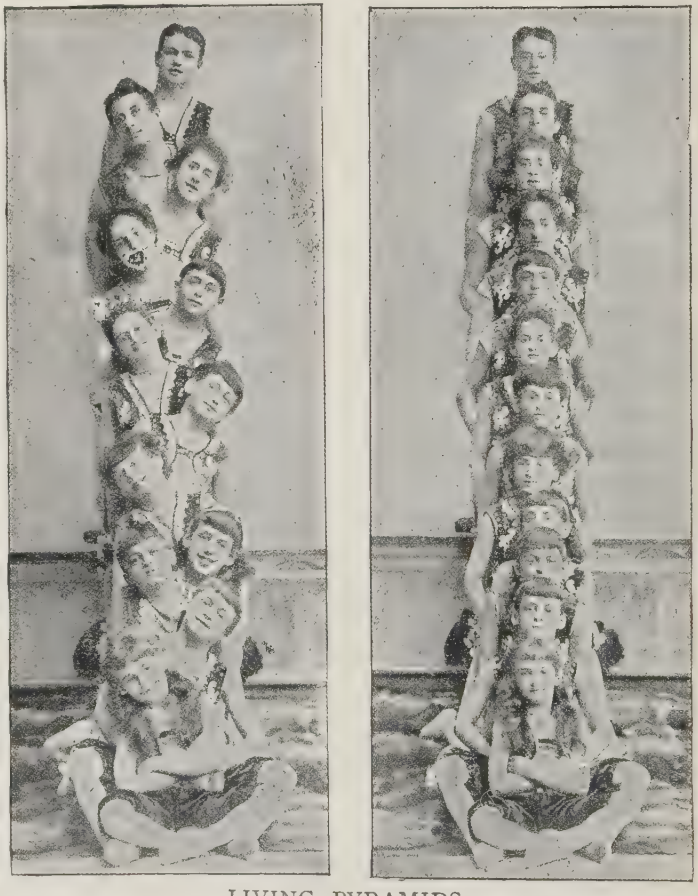
FAMILY OF ATHLETES

How They are Trained and What They Do—Marvelous Feats, Including Triple Somersaults.

THE Kremo family is a well known family of athletes and are remarkably clever. Both mother and father are Austrians, the former having been for many years a circus rider of distinction, while the latter was a celebrated acrobat himself, and has trained his children to follow in his footsteps most admirably. Eleven of the family are their own children, the other two members of the troupe being nephews. Of the eleven, five are girls, the other six boys, including a pair of twins.

The actual training of these child acrobats usually starts after their fourth birthday, in some cases slightly later, and continues for three years before they are considered fit to appear in public. After this at least two hours a day are devoted to practice, irrespective of the evening performance, and every child is taught dancing in order to acquire grace of movement and pose. All the Kremos are skilful trapezists, stationary and flying, as well as experts on the horizontal bars.

One of their famous performances consists mainly of what is technically known as "risley" work, in which one performer, resting on a shaped stool on the ground, uses his upturned feet with which, so to speak, to juggle with the smaller members of the troupe. Single, double and even triple somersaults are achieved with apparently little effort.



LIVING PYRAMIDS.

VAST COAL BEDS OF THE UNITED STATES

THE coal era of the United States is divided into several district fields, to wit.: (1) the Alleghany field, reaching from the Alleghany Mountains on the west side of the middle of the State of Alabama, with a computed area of 58,737 square miles; (2) the Illinois field, covering a large portion of the State of Illinois, and reaching into Indiana and Kentucky. Its area is estimated at 64,887 square miles; (3) the Missouri field, including portions of the States of Iowa, Kansas, Arkansas, Missouri and Texas, and estimated as covering 47,138 square miles.

The bituminous division includes the following fields: (1) the New Red Sandstone formation in the Richmond basin in Virginia, and extending into North Carolina; (2) the Appalachian field, which extends from the State of New York on the north to the State of Alabama on the south, having a length northeast and southwest of over 900 miles, and a width ranging from 30 to 180 miles; (3) the Northern field, which is confined exclusively to the central part of Michigan; (4) the Central field, embracing the coal areas in Indiana, Illinois and Western Kentucky; (5) the Western field, including the coal areas west of the Mississippi river, south of the 43d parallel of north latitude and east of the Rocky Mountains; (6) the Rocky Mountain field; and (7) the Pacific Coast field.

When the anthracite tracts of Pennsylvania and Rhode Island, and the coal fields of Virginia, Michigan and North Carolina, with the productive coal areas in the far west, are added, it will readily be seen that the coal area of the United States will largely exceed 200,000 square miles. Coals are primarily divided into two great groups—the hard and the soft, or the anthracite and the bituminous coals. Each of these groups is capable of subdivision into several varieties.

The prevailing variety in the Rhode Island coal tract is the graphitic anthracite. It contains one or two per cent. of gaseous matter, ignites with difficulty, and forms an inferior fuel. Anthracite contains from three to ten per cent. volatile matter, and sometimes ninety-five per cent. of carbon, and ignites with some difficulty, but produces an intense heat.

In the valley of the Mississippi the

coals are of the bituminous class. In the Alleghanies the coals have lost a portion of their volatile matter, and have become

TYPICAL COAL MINE OPENING, FAIRMONT REGION, MARION CO., W. VA.

semi-bituminous. The coals of Blossburg, Broad Top, Frostburg, and a belt running down into Alabama, belong to this group. There is in Rhode Island a coal-basin of limited extent of the same age as those of Pennsylvania; but it seems to have been nearer the focus of metamorphic action, for the coal is partially converted into graphite, forming the variety known as graphitic anthracite.

Coal areas are distributed as follows,

so far as positive data are obtainable: Great Britain, 11,859 square miles; France, 2,000 square miles; Belgium, 500 square miles; Prussia, 2,000 square miles; Austria, 18,000 square miles; Russia, 20,000 square miles. The coal area of Spain is not definitely known. Her coal field in the province of Asturias is one of the most important on the continent of Europe, but as yet her coal production is small.

Recent discoveries have shown that Russia has much larger coal fields than were formerly credited to her, and by some explorers it has been estimated that at least 30,000 square miles of territory within her confines are coal beds of different ages.

EARTHQUAKES IN THE UNITED STATES

Alarming Convulsions Attended With Loss of Life and Property.
Ruinous Earthquake at Charleston, South Carolina.
Disasters Recorded in History.

THERE is nothing to warn us of the approach of the earthquakes, neither in the heavens above, nor the earth beneath, nor the waters under the earth. Has the reader ever experienced one of these strange earth storms? Perhaps not. Is it believed they are rare? They are as common as storms in the atmosphere. Within a period of seven years four thousand six hundred and twenty have been recorded.

Many more doubtless occurred completely beyond the pale of civilization. Hundreds have passed unnoticed save by delicate instruments. Not a day passes without several being recorded. They are as widely various in power as the storm and the breeze. Not a region on earth is unvisited by them.

Yet the reader will be disposed to think that the United States is almost free from these visitants. To a certain extent it is. We have not in all our history had a shock of extreme violence or one that can compare in destructiveness with the strange convulsions of tropical regions; but in the rarity of shocks we are not so favored as might be supposed. A few moments' consideration of the records will be sufficiently convincing.

In the memoirs of the "Academy of the Arts and Sciences" in Boston, is a paper by Professor Williams, recounting the story of some of the earlier earthquakes in our history.

The first one noticed after the landing of the Pilgrims occurred June 1, 1638. We are told it was preceded by a rum-

bling noise like remote thunder, which gradually grew louder and nearer. Then the earth began to quake till pewter and crockery tumbled from the shelves, stone walls toppled over, and chimneys crumbled and fell. The shock passed from northwest to southeast and was followed by a second in half an hour. People found it difficult to keep their feet. It occurred in the afternoon, but there is no means of knowing what area was affected. As the country was then unsettled the damage done was of course slight.

Warned of Divine Wrath.

Nearly four years later occurred a light shock, barely noticeable, in the same region. In 1653 an earthquake on the 29th of October stirred up the Puritan divines to admonish their flocks of the wrath of God. Still another occasion of the same sort was given in 1658. But of this latter, though we are told it was a very great earthquake, we have neither day nor month nor any record of its violence, extent or duration.

The first convulsion of which there is any detailed account, occured in 1663, January 26–28, Old Style. An old narrative thus records it:

"About half an hour after five in the evening a most terrible earthquake began. The heavens being serene, there was suddenly heard a roar like the noise of a great fire. Immediately the buildings were shaken with amazing violence. The doors opened and shut of themselves with a fearful clattering. The bells rang without their ropes being touched. Cracks appeared in the walls of buildings, and floors separated and in some cases fell down.

"Chasms appeared in the fields, and the hills seemed to be in motion. The fright of the inhabitants was shared by the beasts and birds, who sent forth fearful cries, howlings and bellowings. The duration of this earthquake was very uncommon. The first shock continued half an hour before it was over, but it began to abate about a quarter of an hour after it began." (Probably there were a considerable number of shocks, gradually lessening in violence.)

"The same day about eight o'clock in the evening, there came a second shock, equally violent as the first, and within the space of half an hour there were two others. Next day about three hours from the morning, there was a violent shock, which lasted a long time, and the next night counted some thirty-two shocks, of which many were violent. Nor did the trembling of the earth cease until the July following. Many trees were torn up, and the outlines of the mountains appeared to be much changed. Many springs and small streams were dried up; in others the waters became sulphurous, and the channels in which some had run were so altered as to be unrecognizable.

Hills Overthrown.

"Half way between Tadousac and Quebec two hills were thrown down and formed a point of land which extended half a quarter of a league into the St. Lawrence river. The island Aux Coudres became larger than it was before, and the channel of the St. Lawrence was greatly changed."

This is, perhaps, as severe a shock as has been felt in this country; but, though the shock extended southward to Pennsyl-

vania, its chief energy was centered in a narrow strip on the St. Lawrence, giving our Canadian neighbors the lion's share of the fright. Other light shocks were noticed in New England in 1665, 1668, 1669, 1670, 1705, and 1720.

New Hampshire Shaken.

October 29, 1727, another severe earthquake was experienced about 10.40 P. M. It seems to have had Southern New Hampshire as its focus, extending thence to the Delaware and Kennebec rivers. Its approach was heralded by a subdued roar from the northwest, which, as it drew nearer, "was thought to be the roar of a blazing chimney near at hand, and at last was likened to the rattling of carriages driven fiercely over pavements. In about half a minute from the time the noise was first heard, the earthquake was felt. It was observed by those who were abroad that, as the shake passed under them, the surface of the earth rose and sank."

Houses trembled and rocked, as though about to fall to pieces. Movables were dashed about with a fearful clatter. Crockery was smashed, stone walls and chimneys thrown down. At Newbury, ashes and sulphur were cast forth from the earth, and also volumes of sand. Sulphuretted hydrogen seems to have been present in large quantities; also chemicals readily decomposed by warmth and moisture.

A correspondent of the Royal Society wrote that a clergyman near Boston assured him "that immediately after the earthquake there was such a stink that the family could scarce bear to be in the house for a considerable time that night." Another clergyman writes that in the following April, the fine sand thrown up by the earthquake "had a very offensive stench—nay, it was more nauseous than a putrefying corpse; yet, in a very little while after, it had no smell at all. How long it was before it began to have this stench I am not certain, but I believe it was covered with snow until a little while before."

Another minister records that "about three days before the earthquake there was perceived an ill-stinking smell in the water of several wells. Some searched their wells, but found nothing that might thus affect them. The scent was so strong and offensive that for eight or ten days they entirely omitted using it. In the deepest of these wells, which was about thirty-six feet, the water was turned to a brimstone color, but had nothing of the smell, and was thick like puddle water." Some wells, dry just before the shock, immediately filled up. Occasional shocks were felt for some months after.

Escape of Gases.

From the phenomena present here, and in many similar cases, it will appear that large volumes of pent-up gases may be discharged in districts remote from any volcanic region. In some instances we are informed that immediately after severe shocks, the streams and vegetation have proved poisonous to cattle. There were slight shocks felt in 1732, 1737 and 1744, but none of these are said to have done any damage beyond throwing down a few stone walls.

Thus we find within a century fourteen earthquake periods in New England alone; and in several cases the shocks

were numerous, extending over a period of several months. Comparing the small area with the whole region, and remembering the shocks are more frequent in the central, southern and western portions of the country, it is fair to conclude that the merest tithe of those actually occurring could have come under the notice of our ancestors.

A Rumbling Roar.

The most violent shock ever known in New England came eighteen days after the great Lisbon earthquake of 1755, preceded by a peculiar, rumbling roar. Then came a "rapid, jarring, vibrating motion," with an upward shock; then a "violent, prodigious shock, as suddenly, to all appearances, as a thunderclap breaking upon a house and attended by a great noise."

Then followed a series of "quick and violent concussions, jerks and wrenches, attended by an undulating, waving motion of the whole surface of the ground, not unlike the shaking and quaking of a large bog."

Several writers give a graphic account of the behavior of the good people of Boston at this juncture. The shock came at a little past four in the morning. Some sprang from their beds and ran into the street; some lay shivering with fear, not daring to rise; others rushed to the windows, and, seeing in the gloom their unclad neighbors rushing about the streets, shrieked aloud that the judgment day was at hand.

Others thought that the heard Gabriel's horn, and fell to their knees, crying for mercy, or fainted away. The boldest feared the crash of tottering houses; children ran about crying for their parents; dogs howled dismally; birds flew aloft with frightened cries; cattle bellowed with fear as they dashed about their pens. Screaming horses struggled in their stalls. Numbers of fish were killed by the shock. Changes were wrought in springs and streams, after the manner of 1727.

The damage done was not so great as might have been expected from the unusual alarm shown. A large number of chimneys in Boston were thrown down; clocks were stopped; a new vane was broken from the market house, the spindle being snapped at a place where it was five inches thick; but we are not told of any serious loss of life or property

Traveled Southward.

The shock extended southward, and was plainly felt along the east side of the Chesapeake, but not on the western shore. The sea wave set in motion traveled southward, and it is supposed to have occasioned the unusual commotion of the water in the West Indies. At St. Martin's the sea suddenly fell five feet below its level, and then rose six above.

The time of the shock was determined exactly by an accident. Professor Winthrop, of Cambridge, had placed a long glass tube in his tall clock, as a safe place. This tube, thrown against the pendulum, stopped the clock, which the day before had been adjusted to meridianal noon; and as Professor Winthrop had compared his watch and clock the night before, he was able to show that the shock began at eleven minutes and thirty-five seconds after four A. M., November 18th, and continued four and a half minutes.

Eighteen periods of earthquakes are noted in the next fifty-five years; and at

one of these, in 1791, nearly one hundred and fifty shocks were felt.

In 1810–11–12 a series of remarkable shocks were felt throughout a large portion of the United States, but with especial force in the central Mississippi valley. The first were noticed near St. Genevieve, but the centre of violence seemed to lie around New Madrid, Mo. The shocks became so sharp and frequent that Dr. Robinson was sent out to observe and record them carefully. He kept count up to five hundred, and then abandoned that portion of the work.

Huge Fissures.

The phenomena were much like those of the milder type of earthquakes everywhere. Around New Madrid huge fissures opening in the earth emitting volumes of sand and gas, occasionally spouting water, or sending out bursts of flame. Some of the fissures were six hundred feet long and twenty feet wide. The sand and water was sometimes thrown as high as forty or fifty feet.

During the whole period there were unusual disturbances in other regions. On the night of the most violent shocks occurred the great earthquake at Caracas, Venezuela, which destroyed so many thousands. Had the Mississippi region been a very thickly settled one, the loss of life would have been fearful. Upon the upheaval of a new island, Sabrina, in the Azores, to a height of three hundred and twenty feet, and an eruption of the St. Vincent volcano, in the Antilles, the disturbance ceased.

These earthquakes were so violent in the river itself as to almost shatter boats in mid-stream. Trees at some distance from the bank were hurled into the water with tremendous force. Flashes of fire and moulten matter were thrown to great heights. The explosions seemed like a battery of artillery. Sunken logs and snags were thrown from the deep bottom of the river to a height of thirty feet above the surface. Sulphurous streams dashed from a thousand rents, leaving unfathomable fissures. Great forest trees lashed their heads together or were snapped off by the shocks.

Small islands sank to the bottom of the river. Quantities of coal and charred wood were thrown up, some lying a considerable distance from the tissues that discharged them. Many boats were lost; quite a number of people were buried under falling banks. It was undoubtedly the most violent convulsion in the history of our country. Reelfoot Lake, now a noted fishing resort, we are told, was formed by this earthquake.

Charleston's Upheaval.

The great Charleston earthquake is of comparatively recent date.

This convulsion owes its importance rather to its location than to its violence. It was felt over about one-fourth of the entire country, its greatest force being felt along the Atlantic coast from New Haven to Savannah. The area affected was elliptical, and the shock was but little less severe at Atlanta, Ga., in east Tennessee and many North and South Carolina regions than in Charleston itself. It was felt at Charleston at 9.51, August 31, 1886, and reached Toronto, Canada, in four minutes. It did not travel so readily westward as northward.

It is, of course, impossible to estimate

exactly the damage done. A considerable number of important cities suffered more or less, but the majority were forgotten in the unusual severity at Charleston. The city appeared as though it had been through a siege or as if a gigantic charge of dynamite had been exploded beneath it. In all directions might be seen heaps of ruins, houses tottering, cracked, twisted—in all stages of destruction

Crumbling Buildings.

Ever and anon a fresh shock brought down some crumbling edifice with a sullen roar and a cloud of stifling dust veiled it from view. The night resounded with the screams of terrified fugitives, the tread of hurrying feet and the groans and cries of the wounded. The parks swarmed with those in search of a place of safety. Hundreds were bruised or maimed by falling stones and timbers; not a few were killed outright; others, crushed in the wrecks, died a lingering death.

Appeals for aid were promptly responded to by all portions of the country. Even those localities which had themselves suffered severely, came to the aid of the city that had been more sorely stricken.

The greatest injury to life was indirect. Only forty-seven people, it is said, were killed outright. But few houses were left safe; and for considerable time young and old, rich and poor, the feeble and the strong, were out of doors in tents, booths, or such rude shelters as they could hastily erect. The alarm was perpetuated by occasional recurrence of the shocks during several days. The continued exposure and lack of necessaries created a vast deal of sickness, and the deaths thus indirectly occasioned far exceeded those killed outright.

Immense Damage.

The damage to buildings in Chareston is estimated at $5,000,000. But in comparison with the whole number injured, comparatively few of the houses were shaken completely down. Hundreds were shaken and shattered, to the point of falling, and had to be pulled down as unsafe. The shock was just short of a point where it would have made terrible havoc. If violent enough to overthrow the many houses it merely shattered, its victims would have been numbered by thousands, instead of tens. We may be thankful that things were not worse.

The nature of the shocks varied. In some parts of South Carolina chimneys and brick walls remained upright, but crushed to atoms at the base, as if shattered by a powerful upward concussion; in other locations, evidences of a twisting motion were present; houses were turned partially around, and left almost unharmed.

Again, as in most cases in Charleston, the chief movement appeared to be a horizontal one—the upper portions of walls and buildings being thrown down, while the lower suffered little harm. More of these singular effects will be noticed in connection with other shocks. Crevices and fissures were opened; railroad rails bent in a snake-like form; mud, sand, and small stones were thrown out. There was no tidal wave, and artesian wells four hundred feet deep were not disturbed.

There was no barometic variation, though the air is said to have suddenly become oppressively hot at the moment of the shock. Some Pennsylvania gas wells diminished, and a geyser in the Yellowstone Park, four years quiet, burst suddenly into action. These we must deem mere coincidences.

As a whole, this has been the most destructive single earthquake in our history, while far inferior in real violence to the convulsions last noticed. For frequency of shocks, and total damage in consequence, the Pacific States far exceed all the rest of the country. Their position with active volcanic regions in Oregon and Washington and Lower California, renders them peculiarly liable to such disturbances

Within the years 1872–1885, inclusive, there were registered seventy-five earthquakes in New England, sixty-six in the Atlantic States, seventy-five in the Mississippi Valley and two hundred and thirty-seven in the Pacific States.

These facts ought to be conclusive evidence against the belief that, because storms and earthquakes are sometimes simultaneous, the one is in any way responsible for the other. These figures show the fewest shocks in the region most frequented by tornadoes; while the section never visited by the latter shows more shocks than all the rest combined. Add to these the previous shocks recorded in our history—231—and it is evident that we have our full share of such convulsions.

LIST OF GREAT EARTHQUAKE DISASTERS.

AMONG the manifold disasters which are constantly overtaking the human family, there is none so full of awe and terror as the earthquake. From the beginning of history, and long before, the habitations of men have been leveled or buried underground by earthquake shocks and volcanic eruptions, and the numbers of human beings killed in this way passes comprehension. In seventy-five years—that is, from 1783 to 1857—the Kingdom of Naples lost 111,000 inhabitants by earthquakes. This is at the rate of more than 1500 per year out of a population of 6,000,0000.

The most disastrous earthquake of recent history was the great Lisbon shock, on Nov. 1, 1755. In less than eight minutes almost all the houses of Lisbon were overturned, 50,000 of the inhabitants were killed, and the whole streets were buried. The cities of Coimbra, Oporto, Braga and St. Ubes were destroyed. Malaga, in Spain, was largely reduced to ruins. One-half of Fez, in Morocco, was destroyed, and 12,000 Arabs killed. The island of Madeira was laid waste, and the ruin extended to Mitylene in the archipelago, where half the town was laid low. The shock was felt 5000 miles away, and even Scotland was given a slight upheaval.

Following is a list of the principal earthquakes of history:

345 B. C. Twelve cities in the Campana buried, and Duras, in Greece, destroyed with immense loss of life.

283 B. C. Lysimachi and its inhabitants buried.

106 A. D. Four cities in Asia, two in Greece, two in Galatia destroyed.

157. One hundred and fifty cities in Asia, Pontus and Macedonia buried.

557. Constantinople partly destroyed; thousands perished.
742. Five hundred cities in Asia, Syria and Palestine overturned; immense loss of life.
936. Constantinople again destroyed. All Greece shaken.
1089. England thoroughly shaken.
1137. Cantania, Sicily, destroyed; 15,000 lives lost.
1158. In Syria, 20,000 lives lost.
1268. In Silesia, 60,000 perished.
1318. In England, greatest known there.
1456, Dec. 5. Forty thousand perish at Naples.
1531, Feb. 26. Lisbon, 1500 houses destroyed and 30,000 persons killed; several neighboring towns swallowed up in the sea.
1580, April 6, St. Paul's, London, partly destroyed.
1596. Japan, cities destroyed and thousands perished.
1626, July 30. At Naples, thirty towns destroyed; 70,000 lives lost.
1667, April 6. At Schamaki; 80,000 die.
1692, June 7. At Jamaica, 3000 killed.
1693, September. In Sicily; 100,000 lives lost.
1703. Jeddo, Japan; 200,000 dead.
1706. Abruzzi, Italy; 15,000 perished.
1716, May. Algiers; more than 20,000 lost.
1731, Nov. 30. One hundred thousand people buried at Pekin.
1732. Naples, 1940 lives lost.
1746, Oct 28. Lima, Peru and Callao destroyed; 18,000 persons were buried.
1751, Nov. 21. San Domingo overwhelmed. Immense loss of life.
1754, September. Cairo, loss of 40,000 lives.
1754, June 7. Kaschan, Persia, overturned, 40,000 people killed.
1755, Nov. 1. Great Lisbon shock; 50,000 people killed at Lisbon, 12,000 Arabs in Morocco buried, 2000 houses in the Grecian archipelago overturned.
1759, Oct. 30. Baaldec, Syria, destroyed; 20,000 persons killed.
1773, June 7. Santiago, Guatemala and its inhabitants swallowed up.
1783, Feb, 4. Towns in Italy and Sicily destroyed, thousands perish.
1784, July 23. Ezinghian, near Erzeroum, destroyed, 5000 killed.
1788, Oct. 12. St. Lucia, near Martinique; 900 killed.
1797, Feb. 4. Panama, 40,000 people buried suddenly.
1800-1842. Great shocks with awful loss of life in Constantinople, Holland, Naples, the Azores, the Mississippi Valley, Caracas, India, Genoa, Aleppo, Chile, Spain, China, Martinique and Guadaloupe.
1868, Aug. 13. Cities in Ecuador, destroyed; 25,000 killed and property loss $300,000,000.
1883, Aug. 3. Island of Ischia almost destroyed; 2000 lives lost.
1884, April 22. Earthquake general throughout England.
1886, Aug. 31. Charleston, S. C.; forty-seven lives lost, $5,000,000 property destroyed.

EXTENSIVE AND CALAMITOUS EARTHQUAKE IN THE WESTERN PART OF THE UNITED STATES.

EARTHQUAKES in the United States have been of comparatively rare occurrence, so far as any extensive destruction of life and property has been involved. By far the most important of these, prior to the disastrous California earthquakes in 1865 and 1868, was that which took place at New Madrid, in Missouri, below St. Louis, on the Mississippi, in 1811, and which is always spoken of in that section as "the great earthquake."

Over a region of country three hundred miles in length, from the mouth of the Ohio to that of St. Francis, the ground rose and sank in great inundations, and lakes were formed and again drained. Humboldt remarks that it presents one of the few examples of an incessant quaking of the ground for successive months far from any volcano.

The central point of violence in this remarkable earthquake was thought to be near the Little Prairie, twenty five or thirty miles below New Madrid, the vibrations from which were felt all over the valley of the Ohio as high up as Pittsburg. The first shock was felt on the night of December 16, 1811, and was repeated at intervals with decreasing severity into February following. New Madrid, having suffered more than any other town on the Mississippi from its effects, was considered as situated near the focus whence the undulations proceeded.

The water of the river, which the day before was tolerably clear, being rather low, changed to a reddish hue and became thick with mud thrown up from its bottom while the surface, lashed vehemently by the convulsion of the earth beneath, was covered with foam, which, gathering into masses the size of a barrel, floated along on the trembling surface. The earth on the shores opened in wide fissures, and, closing again, threw the water, sand and mud in huge jets higher than the tops of the trees.

The atmosphere was filled with a thick vapor or gas, to which the light imparted a purple tinge, altogether different in appearance from the autumnal haze of an Indian summer or that of smoke. From the temporary check to the current by the heaving up of the bottom, the sinking of the banks and the sand-bars into the bed of the stream, the river rose in a few minutes five or six feet, and, impatient of the restraint, again rushed forward with redoubled impetuosity, hurrying along the boats now set loose by the panic-stricken boatmen, as in less danger on the water than at the shore, where the bank threatened every moment to destroy them by the falling earth or carry them down in the vortices of the sinking masses.

Many boats were overwhelmed in this manner and their crews perished with them. Numerous boats were wrecked on the snags and old trees thrown up from the bottom of the Mississippi, where they had quietly rested for ages, while others were sunk or stranded on the sand-bars and islands. At New Madrid several boats were carried by the reflux of the current into a small stream that puts into the river just above the town, and left on the

ground by the returning water a very considerable distance from the Mississipi.

It is an interesting coincidence that, at this precise period, the first steamboat voyage ever made in western waters added the novelty of its occurrence to the convulsions of nature in this region. The name of the steamboat in question was the "New Orleans," commanded by Mr. Roosevelt.

Coal Already Quarried.

On arriving about five miles above the Yellow Banks, near New Madrid, they moored opposite to a vein of coal on the Indiana side, the coal having been purchased some time previously for the steamer's use. They found a large quantity already quarried to their hand and carried to the shore by depredators, who, however, had not means to carry it off: and with this they commenced loading. While thus engaged, the voyagers were accosted in great alarm by the squatters in the neighborhood, who inquired if they had not heard strange noises on the river and in the woods in the course of the preceding day, and perceived the shores shake, insisting that they had repeatedly heard the earth tremble.

Hitherto, however, nothing remarkable had been perceived, and the following day they continued their monotonous voyage in those vast solitudes. The weather was oppressively hot; the air misty, still and dull; and though the sun was visible, like an immense and glowing ball of copper, his rays hardly shed more than a mournful twilight on the surface of the water. Evening drew nigh, and with it some indications of what was passing around them became evident, for they ever and anon heard a rushing sound and violent splash, and finally saw large portions of the shore tearing away from the land and lapsing into the watery abyss.

An eye witness says: "It was a startling scene—one could have heard a pin drop on deck. The crew spoke but little; they noticed, too, that the comet, for some time visible in the heavens, had suddenly disappeared, and everyone on board was thunderstruck."

The second day after leaving the Yellow Banks, the sun rose over the forests, the same dim ball of fire, and the air was thick, heavy, and oppressive as before. The portentious signs of this terrible natural convulsion increased. Alarmed and confused, the pilot affirmed he was lost, as he found the channel everywhere altered, and where he had hitherto known deep water, there lay numberless trees with their roots upward. The trees that still remained were seen waving and nodding on the banks, without a wind. The adventurers had, of course, no choice but to continue their route as best they could, but towards evening they were at a loss for a place of shelter.

Island Had Disappeared.

They had usually brought to under the shore, but at all points they saw the high banks disappearing, overwhelming many an unfortunate craft from which the owners had landed in the hope of effecting their escape. A large island in midchannel, which had been selected by the pilot as the better alternative, was sought for in vain, having totally disappeared, and thousands of acres constituting the surrounding country were found to have been swallowed up.

Thus, in doubt and terror, they proceeded hour after hour until dark, when they found a small island and rounded to, mooring at the foot of it. Here they lay, keeping watch on deck during the long night, listening to the sound of the waters which roared and whirled wildly around them, hearing also from time to time the rushing earth slide from the shore and the commotion of the falling mass as it became engulfed in the river.

The Cabin Shakes.

The lady of the party was frequently awakened from her restless slumber by the jar of the furniture and loose articles in the cabin, as in the course of the night the shock of the passing earthquake was communicated to the bows of the vessel. The morning dawned and showed they were near the mouth of the Ohio. The shores and channel were now equally unrecognizable — everything seemed changed. About noon that day they reached New Madrid. Here the inhabitants were in the greatest consternation and distress.

Part of the population had fled for their lives to the higher grounds; others prayed to be taken on board the steamer, as the earth was opening in fissures on every side and their houses hourly falling around them. Proceeding thence they found the Mississippi, at all times a fearful stream, unusually swollen, turbid and full of trees, and after many days of extreme danger finally reached Natchez.

After shaking the valley of the Mississippi to its center, the earthquake vibrated along the courses of the rivers and valleys, and, passing the primitive mountain barriers, died away along the shores of the Atlantic ocean. In the region of its greatest force, and pending the tremendous elemental strife which finally ensued, the current of the Mississippi was driven back from its source with appalling velocity for several hours, in consequence of an elevation of its bed.

But the noble river was not thus to be stayed in its course. Its accumulated waters came booming on, and, overtopping the barrier thus suddenly raised, carried everything before them with resistless power. Boats, then floating on its surface, shot down the declivity like an arrow from a bow, amid roaring billows and the wildest disorder.

A few days' action of its powerful current sufficed to wear away every vestige of the barrier thus strangely interposed, and its waters moved on in their wonted channel to the ocean, seemingly rejoicing in their triumph over the opposing elements and forces.

Shock After Shock.

The day that succeeded this night of dread brought no solace in its dawn. Shock followed shock; a dense black cloud of vapor overshadowed the land, through which no struggling sunbeam found its way to cheer the desponding heart of man. The appearances that presented themselves after the subsidence of the principal commotion were indeed staggering to the beholder.

Hills had disappeared, and lakes were found in their stead; numerous lakes became elevated ground, over the surface of which vast heaps of sand were scattered in every direction; while in many places the earth for miles was sunk below the general level of the surrounding

country, without being covered with water —leaving an impression in miniature of a catastrophe much more important in its effects, which had, perhaps, preceded it ages before.

Immense Lake Formed.

One of the lakes thus formed is sixty or seventy miles in length, and from three to twenty miles in breadth; it is also in some places very shallow, and in others from fifty to one hundred feet deep, which latter is much more than the depth of the Mississippi river in that quarter. In sailing over its surface, one is struck with astonishment at beholding the gigantic trees of the forest standing partially exposed amid the waste of waters, branchless and leafless, like gaunt, mysterious monsters.

But this wonder is still further increased on casting the eye on the dark-blue profound, to witness cane-brakes covering its bottom, over which a mammoth species of tortoise is occasionally seen dragging its slow length along, while countless millions of fish are sporting through the aquatic thickets—the whole constituting one of the most remarkable features in American scenery and topography.

The lost hills or islands before mentioned are of various extent; some twenty or thirty miles in circumference, others not so large, and some are even diminutive in size but of great altitude, occasionally furnished with fountains of living water, and all well timbered.

The low grounds are in the form of basins, connected by openings or hollows; these, not being as deep as the bottom of their reservoirs, it happens that when an inundation takes place, either from the Mississippi river or streams issuing from the surrounding highlands, they are filled to overflowing—and, when the waters recede below a level with these points of communication, they become stagnant pools, passing off by the process of infiltration, which is very slow, in a thick, black, tenacious loam, or by evaporation equally gradual, in a country covered by forests and impenetrable jungle.

At New Madrid and its vicinity, the earth broke into innumerable fissures; the church yard, with its dead, was torn from the bank and embosomed in the turbid stream, and in many places the gaping earth unfolded its secrets—the bones of the gigantic mastodon and ichthyosaurus, hidden within its bosom for ages, being brought to the surface. Even at the present day, frequent slight shocks of earthquake are there felt, and it is asserted that in the vast swamp at the back of the town, strange sounds may at times be heard, as of some mighty cauldron seething and bubbling in the bowels of the earth and threatening to break forth.

Earth Rents.

Flint, the geographer, who visited the country seven years after the event, says that at the time of his visit, a district west of New Madrid still remained covered with water, and that the neighboring forest presented a scene of great confusion. He also saw hundreds of deep chasms remaining in the alluvial soil, which were produced, according to the inhabitants, by the bursting of the earth, which rose in great undulations, and discharged prodigious volumes of water,

sand and coaly matter, thrown up to a great height.

As the shocks lasted throughout a period of three months, the country people remarked that in particular districts, there were certain prevailing directions in which the fissures opened, and they accordingly felled the tallest trees, making them fall at right angles to the direction of the chasms. By stationing themselves on these, the inhabitants often escaped being swallowed up when the earth opened beneath them.

Trees Bent Down.

During the visit of Sir Charles Lyell to this region, in 1846, Mr. Bringier, the well-known engineer, related to him that he was on horseback near New Madrid, in 1811, when some of the severest shocks were experienced, and that as the waves advanced he saw the trees bend down, and often, the instant afterward, when in the act of recovering their position, meet the boughs of other trees similarly inclined, so as to become interlocked, being prevented from righting themselves again.

The transit of the wave through the woods was marked by the crashing noise of countless branches, first heard on one side and then on the other. At the same time powerful jets of water, mixed with sand, loam and bituminous shale, were cast up with such impetuosity that both horse and rider might have perished, had the swelling and upheaving ground happened to burst immediately beneath them.

Some of the shocks were perpendicular, while others, much more desolating, were horizontal, or moved along like great waves; and where the principal fountains of mud and water were thrown up, circular cavities, called sink-holes, were formed.

Hearing that some of these cavities still existed near the town, Professor Lyell went to see one of them, three-quarters of a mile to the westward. There he found a nearly circular hollow, ten yards wide, and five feet deep, with a smaller one near it, and, scattered about the surrounding level ground, were fragments of black bituminous shale, with much white sand.

Within a distance of a few hundred yards, were five more of these "sand-bursts," or "sand-blows," as they are sometimes termed, and, about a mile farther west, there is still pointed out "the sink-hole where the negro was drowned." It is a striking object, interrupting the regularity of a flat plain, the sides very steep, and twenty-eight feet deep from the top to the water's edge.

Professor Lyell's Account.

In the interesting account of this region and of the event in question, furnished by Professor Lyell, in his book of travels, he relates the reminiscences of a citizen of New Madrid, who witnessed the earthquake when a child. He described the camping out of the people in the night when the first shocks occurred, and how some were wounded by the falling of chimneys, and the bodies of others drawn out of the ruins; and confirmed the published statements of the inhabitants having availed themselves of fallen trees to avoid being engulphed in open fissures—a singular mode of escape, which, curiously enough, had been adopted spontaneously

in different and widely-distant places, at the same time, even little children throwing themselve thus on the felled trunks.

Lyell was then invited to go and see several fissures still open, which had been caused by the undulatory movement of the ground, some of them jagged, others even and straight. Two of them were traced continuously for more than half a mile, and a few were found to be parallel; but, on the whole, they varied greatly in direction, some being ten and others forty-five degrees west of north.

They might easily have been mistaken for artificial trenches, though formerly as deep as wells; the action of rains, frost, and occasional inundations, and, above all, the leaves of the forest blown into them in countless numbers, have done much to fill them up.

"The Sunk Country."

In that part of the forest which borders what is called the "sunk country," all the trees of a date prior to 1811, although standing erect and entire, are dead. They are most noticeable objects, are chiefly oaks and walnuts, with trunks several feet in diameter, and many of them more than two hundred years old.

They are supposed to have been killed by the loosening of the roots during the repeated undulations which passed through the soil for three months in succession. The higher level plain, where these dead monarchs of the forest stand, terminates abruptly toward the bayou St. John, and the sudden descent of eight or ten feet throughout an area four or five miles long, and fifty or sixty broad, was one of the strange results of the earthquake. At the lower level are seen cypresses and cotton-wood, and other trees which delight in wet ground, all newer than 1812. The "sunk country" extends along the course of the White Water and its tributaries for a distance of between seventy and eighty miles north and south, and thirty miles east and west.

It is not, however, confined to the region west of the Mississippi, for several extensive forest tracts in Tennessee were submerged during the shocks of 1811–12, and have ever since formed lakes and swamps.

Disastrous Shocks.

Earthquakes in California, especially those which occurred in 1865 and 1868, and both in the month of October, were the most disastrous in respect to the value of property destroyed, that of October 21, 1868, being particularly so. At San Francisco the motion was east and west, and several buildings on Pine, Battery and Sansome streets were thrown down, and a considerable number badly damaged. The ground settled, which threw the buildings out of line.

The principal damage was confined to the lower portion of the city below Montgomery street, and among old buildings on the made ground. The custom house, a brick building erected on pile ground, which was badly shattered in the earthquake of 1865, had now to be abandoned as unsafe. Business in the lower part of the city was suspended, the streets were thronged with people, and great excitement prevailed. The parapets, walls and chimneys of a number of houses fell, causing loss of life and many accidents.

At one place the ground opened several inches wide and about forty or fifty

feet long; and in other places the ground opened and water forced itself above the surface. The water in the bay was perfectly smooth at the time of the occurrence, and no perceptible disturbance took place there. The shock was felt aboard the shipping in the harbor, as if the vessels had struck upon the rocks.

Ominous Calm.

The morning was moderately warm, and a dense fog covered the city. Not the slightest breeze was perceptible. The first indication of the approach of the earthquake was a slight rumbling sound, as of something rolling along the sidewalk, coming apparently from the direction of the ocean. The shock commenced in the form of slow, horizontal movements, while the movements of the great earthquake of 1865 were perpendicular.

The effect on buildings, too, of the earthquake of 1868 was widely different from that of 1865. In the latter, glass was broken and shivered into atoms in all the lower parts of the city by the perpendicular oscillations, while comparatively few walls were shaken down or badly shattered.

The earthquake of 1868 broke very little glass, but the damage by the falling of cornices, awnings and walls was immense. Mantel ornaments and shelved crockery were everywhere thrown down and broken; top-heavy articles of furniture tumbled over; tanks and dishes containing water or other liquids slopped their contents; clocks stopped running; door-bells rang; tall structures, like steeples and towers, were seen to sway, and the motion of the earth under the feet was unpleasantly plain to walkers; horses started and snorted, exhibiting every sign of fear, and in some cases dashing off furiously with their riders; dogs crouched, trembling and whining; and fowls flew to the trees, uttering notes of alarm. The panic among women and children was, for a time, excessive, and their cries and tears were very moving.

At Oakland, the shock was very severe, throwing down chimneys, and greatly damaging buildings; in several localities the ground opened, and a strong sulphurous smell was noticed after the shock. The court house at San Leandro was demolished and one life lost. At San Jose, several buildings were injured. The large brick court house at Redwood City was completely wrecked.

Felt in Many Places.

The shock was light at Marysville and Sonora, and severe at Grass Valley. It was also felt, with a good deal of severity, in Stockton, Sonoma, San Lorenzo, Alvarado, San Mateo, Petaluma, Vallejo and Sacramento; in the latter place, flagstaffs and trees vibrated ten feet, and the water in the river rose and fell a foot and a half.

On July 31, 1902, a severe earthquake visited Los Alamos, California, a strip of country fifteen miles long by four miles wide, rent with gaping fissures and dotted with hills and knolls that sprang up during the night as if by magic, a village in ruins and hundreds of persons fleeing for their lives, were the results of earthquakes in the valley of Los Alamos, in the northern part of Santa Barbara county. Although the shocks were many and severe, there was fortunately very little loss of life.

SPORT OF FALCONRY

Training Hawks for the Chase—How the Sport is Conducted.

FALCONRY is the art of trainingfalcons and hawks to the chase. In the East falconry has been traced back to a period anterior to the Christian era, and was practiced there and also in Europe long before its introduction into Britain. Many of the old British kings amused themselves with this sport, and for a long time falconry was the leading amusement, as much so as horse racing and the various games of ball are at the present time.

The birds employed by falconers are of two classes—the long-winged, dark-eyed falcons and the short-winged, yellow-eyed hawks. The former take their prey by rising above it in the air and swooping at it from a considerable height and striking it to the ground; the latter pursue in a straight line, and overtaking the quarry by superior speed, clutch it and come down with it.

The larger falcons are flown at winged game of all kinds—crows, magpies, rooks, herons and wild fowl; the smaller falcons, such as the merlin and hobby, are used for taking larks; while of the short-winged hawks, the sparrow-hawk is flown at blackbirds and thrushes, partridges early in the season, and quails, the goshawk taking pheasants, partridges and will fowl, rabbits and hares.

With all birds of prey the females are invariably larger and more powerful than the males, and the sexes are consequently selected according to the quarry they have to pursue. Jerfalcons are now rarely employed, partly owing to the difficulty of procuring them, partly because the peregrine falcon is preferred, and experience has shown that except in a woody or enclosed country, where the goshawks and sparrow-hawk are preferable, the peregrine is the most useful of all the birds of prey.

Hawks are either taken young from the nest before they can fly, when they are termed "eyesses," or are caught later during the period of their migration by means of a decoy-pigeon and a bow-net, when they are called passage-hawks. The mode of treatment is a little different, inasmuch as the latter have already learned to catch and kill prey for themselves, and only require to be tamed; the former have everything to learn.

A passage-hawk on being caught is hooded, and has "jesses," or soft leather straps, fastened on her legs. She is then set down on a block of turf to prevent

damage to feathers, and fed, once a day at first, through the opening of the hood, afterwards with the hood removed. The bird is always fed upon the gloved hand, and gradually learns to step onto it from the perch, increasing the distance daily until she is obliged to fly to reach the fist.

MONGOLIAN CHIEFS AT THE ROYAL SPORT OF FALCONRY.

The training then commences. The hawk is called off, as it is termed, to the "lure," which means that after tying a long line to the ends of the jesses, she is held hooded on the hands of an assistant until the falconer, at the distance of five-and-twenty yards, swings the lure to which the bird has been accustomed to come to be fed.

The hood being then removed, the hawk flies to the "lure," and is exercised in this way for some time daily, until she is sufficiently tractable to be trusted without a line, care being taken not to feed her until she has flown, and always to reward her for coming to the "lure" with a morsel of the meat with which it has been garnished. She is then entered at the quarry at which she is intended to be flown (partridge, rook, or whatever it may be) by first giving her a live bird at the end of a long line, and allowing her to go off the fist and kill it; eventually the line is dispensed with and she is flown at wild quarry.

Such briefly is the mode of training a passage-hawk. An eyess is somewhat differently treated. A straw-covered platform is put up in some shed or outhouse, and on this the nestlings (which should not be taken too young or they will turn out screamers) are placed, the platform

being about as high as one can reach to feed the birds. They are fed three times a day on lean meat, while growing to keep up their strength, or hunger-traces will appear like cuts across the webs of the feathers, and, the latter breaking will render the birds useless. When they are strong enough and able to fly, jesses are put on the legs and a spherical brass bell (of Dutch or Indian make) on one leg, fastened just above the jess with a little narrow strip of leather.

Falconry is practised among the Mongols, who live for the most part in the immense plateau of Central Asia called Mongolia. These people are nomadic—that is, they have no settled abode, but wander from place to place and live in tents both summer and winter. Our illustration represents the Mongol chiefs engaged in their favorite sport.

The nest of the falcon is generally large, and composed of sticks and herbaceous plants, excepting in localities were none of the latter exist, when it is made of grass. They build in the same localities for years together, and Professor Newton gives an interesting record of such an occurrence, when he mentions a hill in Lapland, where a pair of falcons had a nest when it was visited by the French astronomical expedition in 1736, a nest being re-discovered in the same place in 1799, and again in 1853.

Near the site of its nest the peregrine brooks no intruder, and will even attack an eagle, an instance having been recorded of one of the latter birds being stunned and brought to the ground by a peregrine, who broke its own wing in the attempt, and was liberated by the shepherds to mend its wing as best it could, in gratitude for having delivered their aquiline enemy into their hands.

In Holland, where until recent years hawking was largely carried on under the auspices of royalty, there is a well-known place, called Valkenswaard, where a good many hawks are trapped every autumn during migration, and it is from the neighborhood of this village that many of the most celebrated falconers have come.

WEALTH OF THE PHILIPPINES

The Future of Our New Possessions—Rich Products of the Island. Our Country's Control of the Pacific.

"ONE of the very fortunate circumstances connected with the approaching era of trade development between America and the Orient is the ability to maintain a substantial balance of trade and a fair degree of reciprocity between our country and the new island possessions in the Pacific," says a writer who is regarded as authority on the Eastern question.

"There could, of course, be only a comparatively one-sided development of com-

merce between the two if the Philippines were not in a position to furnish the vessels carrying American wares to their shores with native products for which a profitable sale could be found in the United States. My observations have convinced me that American ships will not be compelled to look elsewhere in the Orient for cargoes to make the return voyage a paying investment.

Golden Opportunities.

"In the Philippines can be found more opportunities for successful investment, with the chance of securing quick and satisfactory returns, than in almost any other region on the face of the globe. All that is required is the acute perception and rapid power of judging a situation inherent in the best type of the American business man. The Philippines have plenty to offer us in return for our exports, but the inhabitants, accustomed to the inactivity due to the climate and the oppression of the Spanish Government, have lost the power of taking the initiative.

"They also lack the initiative necessary to develop the resources of their islands. We must supply this and other needs before we can begin to expect the great results which will unquestionably follow, if the conditions I have mentioned are fulfilled.

"Among the products which the Philippines will, in all probability, be able to export with gratifying success in a comparatively short time, are sugar and tobacco. Sugar can be grown on nearly all of the islands forming the archipelago of which the Philippines constitute the major part, but the process of manufacturing it is of the most primitive kind. In place of being ground between cylinders of steel, the sugar cane is placed between simple stone cylinders, which are revolved by buffaloes in the time-honored fashion.

"The drying process is carried out in an equally primitive manner. The rays of the sun are allowed to accomplish in a leisurely way the results obtained in the ordinary American sugar mill in a fraction of the time, through the medium of artificial heat. If the United States ever stand in need of imported sugar, the necessary supply can be obtained from the Philippines, provided the modern process of manufacturing it is employed and adequate transportation facilities are furnished.

Products that Pay.

"Where sugar is not produced, tobacco will be found to prove a paying product in the islands. What I have said above, the crudeness of the methods employed in the manufacture of sugar, applies with equal if not greater force to the production of tobacco.

"Although Cuba will probably always maintain her supremacy as the chief producer of the finer grades of tobacco, the Philippines surpass her in the production of the minor grades. There is a constant demand in the United States for Sumatra wrappers and this quality of the leaf can be supplied by the islands in enormous quantities. The best Philippine tobacco is grown in the province of Cagayan on the Island of Luzon, where the soil has constituent elements very similar to that of Cuba. It is difficult to set a limit to the possibilities of developing the tobacco trade of the Philippines, as the soil and

climatic conditions of hundreds of the smaller islands are comparatively unknown.

"It can, however, be stated with absolute veracity that tobacco growing and exporting will prove in time to be one of the chief sources of revenue. The islands will, under proper conditions, be able to place on the markets of the world at least as much tobacco as Cuba, which produces about one-seventh of the entire crop of the world. One of the chief problems to be solved in this connection will be the providing of the proper transportation facilities, as I have indicated in speaking of the manufacture of sugar.

Rice Production.

"The rice production in the islands has not advanced beyond the first stages, although the only railroad in existence on the islands in the summer of 1898 connected Manila with the rice-growing districts. There have been years when the crop did not suffice to supply the demand of the inhabitants, but under modern conditions and with the employment of an adequate amount of capital, a crop sufficient to meet a considerable portion of the demand of the Orient could be produced.

"Rice will grow where sugar cane and tobacco will not, and there is an enormous area that is suited for the production of this valuable cereal. The rice fields must be connected by roads which will facilitate transportation, and the method of harvesting the rice must undergo a complete change.

"Coprax, the dried meat of the cocoanut, is an article of commerce from which, in time, a very considerable revenue can be derived. It is exported at present principally to Germany and England, where it is utilized in the manufacture of soap. In Manila and other towns in the islands the oil extracted from coprax is used for lighting purposes.

Available Imports.

"There might be some objection to the importation of sugar from the Philippines into the United States, but there certainly could not be the shadow of a doubt as to the practicability and expediency of importing coprax. Although the trunk, leaves, fibre and every other portion of the cocoanut tree has a commercial value in the Philippines, and is made use of in manufacturing handkerchiefs and other useful articles, coprax takes the lead, because of the simplicity of its preparation for transportation, its durability and the great number of uses to which it can be put.

"A very profitable return is insured to the capitalist who engages in the planting of cocoanut trees. A profit of from ten to forty per cent. is now being realized by those residents who have devoted their attention to this matter, even under the unfavorable conditions that obtain at present. All that is necessary after the planting has been accomplished is to make the proper commercial use of the tree and fruit after the bearing period has been reached."

Thus it appears that the soil of the islands is rich and easily worked. A variety of products are cultivated and these yield lucrative returns, as they are articles of commerce and are exported. It is safe to predict a brilliant future for the Philippines and a rapid growth of wealth.

Most Wonderful Clock

A GERMAN watchmaker has completed what is pronounced by experts to be the most wonderful clock in the world. When he began his work nineteen years ago the watchmaker was in comparative affluence; afterward he became a poor man, and suffered even the penalty of confinement in an insane asylum in order to achieve his ambition.

He first determined upon his work when he saw the world-famous clock at Strasburg Cathedral. Being a watchmaker, and an expert one at that, he fully realized the difficulties to be encountered in surpassing that marvel of mechanism, but this did not deter him.

As the years passed his work progressed, but one by one his worldly possessions left him, sold to buy the materials necessary to his work and to support himself and family while he was devoting his time to it. His wife, who had no sympathy with his ambition, pleaded with him to give it up, and from pleas she went to threats, and finally had him haled before a magistrate, who pronounced him insane.

He was confined to an asylum for some time, but as soon as he regained his liberty he began work once more upon his wonderful clock. His wife again interfered. So miserable did she make his life that he found it impossible to continue his work in his home, and so moved his tools and his clock to Carlsruhe, Baden. Here some local officials became interested in his work and gave him board and lodging free, but at the end of eighteen months he was forced to move again. He went to his son in Switzerland and there obtained more help and also received a gift from the Emperor, who had heard of his wonderful clock. There he completed his work, and while his ambition is achieved, he can find no one to buy the clock from him and is a penniless old man.

The clock is enclosed in glass, making every movement of the works visible, and every part—of which there are no fewer than 2200—is the watchmaker's own handiwork.

The clock indicates the seconds, minutes, hours, days of the week, date of the month, the seasons of the year, the signs of the zodiac, the rising and setting of the sun, the changes of the moon, and the positions of the celestial bodies. It also shows the eclipses of the sun and the moon.

Besides all this, it is beautifully decorated with all kinds of allegorical figures, which move at their own appointed times.

At each quarter, excepting the full hour, two angels advance, strike a bell, and retire into a recess. At the full hour, two other angels appear, the one holding

an hour glass and the other sounding a trumpet. At another part of this wonderful piece of work stands a cock, which at five minutes to twelve mid-day flaps its wings, stretches its neck and crows three times.

There are also figures constantly appearing, representing the four ages of man, while on the right hand side of the dial is a beautifully carved statuette representing the Angel of Death, who points with his scythe to the face of the clock.

Every time the clock strikes twelve, Christ, with bended head, and his twelve apostles advance from a hidden corner, while below a monk rings his Ave.

As each season of the year comes round, a typical picture is exhibited—in Spring, a Spring scene, in which a cuckoo is seen in a tree and is heard to utter its curious cry seven times; in Summer, a fresh scene, with a quail, which likewise calls seven times; in the Autumn, a bull, lying at the feet of St. Luke, bellows; and in Winter a lion, which lies near to St Mark, roars.

Lastly, after the striking of each hour, a chime of bells makes melody for some five or six minutes, each tune lasting about a minute, and it is claimed that the clock will last practically forever, keeping the minutes accurately.

SEVENTEEN-YEAR LOCUST

Most Remarkable Inhabitant of the Insect World—Maturing Many Years Underground for a Six Weeks Life Above It.

SEVENTEEN years of solitude in a dark underground cell; just six weeks of bright-winged, strenuous freedom; then death. That is the tragic history in brief of the periodical cicada or seventeen-year locust, millions of which burst from the earth in the month of May or June after an involuntary imprisonment of seventeen years. They appeared in the States of Pennsylvania, Illinois, Kentucky, North Carolina, the northern part of Georgia, West Virginia, Virginia and Tennessee. If you are walking in the woods in any one of these States and hear a sound like a combination of a distant threshing machine and frog chorus you will know that you have stumbled on a congregation of the periodical cicada.

The owners of fruit trees in the region where the locust is to make its appearance, all alarmed at the prospect are besieging the Department of Agriculture for protection against the visitation, but none can be given. For so far no means have been found of guarding against the ravages of the cicada, which has never yet been known to make a mistake in the date upon which Nature orders him to burst asunder his prison doors.

Between the hour of 9 in the evening

and 1 o'clock in the morning of some fine night in May these locusts swarm from the earth. One ignorant of entomology would pass by the black bug unheeding. Yet it is one of the most remarkable of insects. In countless numbers the locusts, or grasshoppers, to call them by their right name, swarm out of the ground up the trees and crawl out on the young tree shoots. The noise of their progress can be distinctly heard by any one fortunate enough to be in the vicinity.

Woods Full of Them.

The woods are alive with them, each one racing for the topmost perch. When they have chosen a spot for depositing the black outer coat that has served them during their underground existence, but whose period of usefulness is approaching an end, the locusts hang there, awaiting the process of nature.

In a few hours the shell begins to split up the back. From the cavity there appears another being. The shell still clings to the trees. It is left there, dead and useless. The new being is bright colored and pretty. Most important of all, it has wings, and is no longer a crawling bug, but a creature that can fly. It has bright red eyes, a black body, colored orange red in parts, and gauzy wings. In size it is an inch and a half from the head to the tip of the closed wing; from wing tip to wing tip it is fully three inches across.

The winged locust begins its six weeks of outdoor life by hanging to the tree on which it was born and waiting for its flying apparatus to gather strength. It is no simple matter to come back to active life after being buried for seventeen years. Hours must pass before the locusts are able to use their wings at all. Well for them during the first few hours of their new life if no enemy appears to nip their career in the bud.

Locusts and Sparrows.

The farmers and florists always pray that flocks of English sparrows will darken the sky when the locusts emerge from their prisons, for one English sparrow will gobble a dozen locusts in as many seconds. Even after the locusts feel strength in their wings and can fly, if attacked, they seem to fall easy victims to their many enemies.

Apparently, the long time they have been underground deprives them of the instinct of fear, for they make no attempt to escape from their enemies, and, in fact, do not seem to recognize them. Consequently the dragon flies and the soldier bugs are able to stock their larders plentifully during the weeks that the locusts appear.

But with myriads of the winged creatures flying around, the few that serve as meals to the sparrows and the dragon flies and the soldier bugs are not missed. The woods resound with the deafening song of the male cicada. The male sings, it must be noted; the female does not. The female eats; the male does not. The "song" of the cicada is heard only in the daytime, and the noise of a brood in chorus is racking to the nerves.

The notes are made by the male striking together two drums that are suspended beneath its abdomen. They drum from morning to night for six weeks. Then the noise ceases. Those who hear

the drum corps of the periodical cicadas beat their own funeral roll in the woods may well wonder whether or not they will hear that dying note again, for once stilled, the sound will be heard no more for the full period of years.

Busy Females.

While the males are drumming the females are hard at work cutting away at the trees with a pair of sharp saws, preparatory to depositing their eggs so that seventeen years later another brood may appear. It is the females and not the males that the owners of fruit trees dread. The females kill the young trees by cutting the bark and sawing their way into the sap in order to make a safe lodging place for the eggs.

For some days after the males have ended their six weeks of life the females are busily engaged in sawing their way into the trees and depositing their eggs, covering them over with the ragged edges of the bark to hide them from view. Having thus run their course, the females die decently and another chapter in the life of the seventeen-year locust is ended.

A few weeks later, hatching time begins. A tiny head peeps out of one egg, bursts through its prison and pushes its way to the light. The little cicada drops to the earth and immediately burrows out of sight. He never sees his mother. When an occupant has emerged from each of the millions of eggs the ground for miles is perforated by the little creatures, all burrowing down until they reach a suitable spot for the house that is to be their solitary abiding place.

The little cicadas build their homes near the root of some tree or bush, making the structure in cone shape. For the entire period of their seclusion they live on the root that runs near their abode, from time to time shedding their coats and being provided by Dame Nature with another. As the new coats grow the locusts get bigger and bigger, and the house has to be enlarged. This work and the sucking of the juice from the root that grows near the house are all that occupies the time of the locusts until the fateful hour when the rush for freedom begins.

A House of Its Own.

Each locust has a separate habitation. Provided with sharp claws, it is able to scratch around for earth and tiny stones and with these to build a house that is waterproof. So firmly are these houses put together by the queer little architects that one sent through the mail arrived at its destination unbroken. When the scramble for the upper world begins at the end of the seventeen-year term of imprisonment, the locust breaks through the top of the conical habitation, sometimes leaving his outer shell in the crevice in the attempt, and emerges a full-fledged cicada.

There is an erroneous idea that the seventeen-year locust stings. Careful investigation has shown that it is harmless. The female might use her cutting appliances on an animal, under the mistaken impression that she is boring into a tree for the depositing of her eggs. But this does not often happen. In fact, when a scientist, in investigating the story that the seventeen-year locust stings, once offered his finger to a female cicada she could make no impression on it, her cutting apparatus slipping from the smooth and pliable skin.

Another mistaken idea about the seventeen-year locust is that it eats up everything that is green, leaving in its wake a devastated country, like those sent to plague the Egyptian king. As said above, the males do not eat at all during their six weeks of winged life.

As the locust makes its appearance but once in seventeen years, it is not likely that it will ever become popular as an article of diet. The Indians once devoured them with a relish, and Professor Riley and Dr. Howard, two scientific enthusiasts, immolated themselves on the altar of sacrifice by testing the edibility of the periodical cicada. First they made them into a stew and didn't like it. Then they tried them fried in fat and thought they tasted something like shrimps. They refused to recommend them, however. In some sections of the West locusts are dried, ground into a flour and made into a bread. They are said to be palatable in this form.

The cicada, it is thought, will some day become extinct. It is a creature of the wild woods, and as the primitive forest is invaded by man the enemies of the cicada multiply and become more aggressive. Not only is the solitude of the prisoner in the earth invaded by countless ground beetles, which prey upon the occupants of the cones, but hogs and dogs and fowl burrow for them and eat them with a relish. The last return of the locust was in 1902.

FIRST INHABITANTS OF THE WESTERN WORLD

People Who Lived Here Thousands of Years Ago. Ancient Cities and Temples.

MANY centuries before Christ there dwelt in South America a race of men as highly civilized as the ancient Egyptians.

They built great aqueducts over mountains and across valleys; they had walled cities and vast temples dedicated to the worship of the sun-god. In surgery their advancement was such that trephining, one of the most delicate and ingenious operations, was practiced successfully.

Then they were conquered by another and a sturdier race. In time the conquerors became the conquered, overcome by a third race of men, who, in turn, had their day, and fell before their enemies.

By evidences as clear as those of the famous superimposed churches at Rome—three structures built each upon the site of the dust-ridden ruins of a preceding age—these facts about the most ancient inhabitants of Peru have just been revealed.

Notable Peruvian Race.

To Dr. Max Uhle, the German scientist and explorer, now connected with the University of California, the world is indebted for the knowledge. Dr. Uhle offers proof that this Peruvian race did not merely antedate the Incas, but was, indeed, the first of four distinct sovereign peoples who lived and loved and worshiped and waged war before the hosts of Pizarro came to claim the land.

It is the old story of a dominating race rising and planting its standard of conquest, maintaining its sway for several centuries and then crumbling and disappearing from the face of the earth before the onslaughts of a sturdier people.

Dr. Uhle returned to the United States a few weeks ago, after two years spent in exploring Peru, under the direction of the University of California. He is a graduate of the University of Berlin, for which institution he spent several years in South America seeking anthropological data.

Later on he entered the service of the University of Pennsylvania and thence was called to the University of California. In all he has spent seven years in South America, climbing mountains, digging in cemeteries that held the ashes of men dead and buried before Christ was born; invading the buttressed citadels whose defenders have been in their graves fully three thousand years, and prying with scientific curiosity into the sun temples, whose gods have long waited in vain for worshipers.

Just one of Dr. Uhle's discoveries will illustrate his theory of the antiquity of the land of the Incas. In one locality he dug under some Inca structures and found at different and ever-increasing depths four strata of ruins, each belonging to a distinct race of which the world had possessed no former knowledge.

Dr. Uhle became satisfied that not one of these races had existed for fewer than four hundred years, and that the life of some may have been a thousand years. But the conservative German scientist is satisfied to let his theory rest on the lower estimate, which would give for the four races a total duration upon the earth of sixteen hundred years. Possibly Dr. Uhle has turned only the first few leaves of the book of prehistoric knowledge that awaits the investigation of archaeologists down there in Peru. The people were far advanced in some matters of civilization and, unhappily for the inquiring explorer, wofully deficient in others.

Advanced Civilization.

For instance, their engineers were quite adepts at irrigation, as the aqueducts and stone-paved channels throughout their terraced habitations prove. That their surgeons performed the operation of trephining is established by several skulls mended with metal plates, which are in the possession of Dr. Uhle.

Yet, with all this knowledge, it never occurred to even the wisest of them to cultivate the art of writing. There is not the slightest vestige in the ruins of any attempts to use symbols for ideas in any

form. The history of the vanished races can be read only as Dr. Uhle has read it, by studying the ruins and applying the laws that science has established in the exploration of other parts of the world.

The prehistoric sun temple, where thousands of devout worshipers once assembled to pay reverent homage to the source of light, appears to the casual observer somewhat like a mountain side, that shows the marks of erosion from receding water. But each ridge on the side of this mountain is the undisputed part of a terrace from which the walls and ornaments have long ago crumbled away. Within the fortified enclosures of the cities (which in some cases extend for miles through the valleys of the Andes) are many rooms, all connected with each other and all built of sun-dried brick. Within these houses and on the streets of the cities Dr. Uhle found specimens of pottery elaborately decorated. Numerous skulls and well-made implements were also discovered. The inhabitants had evidently tilled the soil and kept vast herds of llamas. These animals are still numerous in the Andes region.

WHY MEN OUTNUMBER WOMEN

WHATEVER differences Dame Nature may have intended between the spheres of influence of men and women, she evidently intended that numerically at least the two sexes should stand on nearly the same footing. The world over, except where recognizable, and what might be called artificial, causes interfere, the male and female elements of the population are about equal.

At first sight perhaps this may not seem remarkable. But it is to be remembered that in many families—large ones, too—the great majority of the children are of one sex or the other. And one should not be surprised if the aggregate effect of this lopsidedness were to produce a considerable excess of men or women in a nation. The fact that such is not the case, then, shows that there is some potent and mysterious law of compensation at work upon the race as a whole. And this law operates upon many of the animals as well as men.

On the farm it is found convenient to preserve a great predominance of one sex over the other in cattle and chickens. The bull calf is predestined from his birth to conversion into veal, and a similarly stern fate consigns the superfluous cockerel to the gridiron or chicken pie at a tender age. But so far as the natural increase is concerned among cattle and poultry, an approximately even balance

is preserved. It is said that there are 512 males and only 488 females in every thousand people in the United States.

What is more, this sort of thing has been going on, with some little fluctuations in the percentage, for over half a century. As long ago as 1850 there was a distinct numerical superiority of the male over the female element. By 1860 the preponderance was even more conspicuous, but in 1870 less than for several decades. The returns for 1880 show a slight gain once more, though the disparity of 1860 was not quite reached, and those for 1890 a stilll further increase. The situation has scarcely changed in the last decade. Indeed, the census bureau figures out a microscopic falling off in the growth of the male population as compared with the female. To be sure, the excess was only 1,560,097 in 1890, and has since been enlarged by 254,727; but the bureau finds that the percentages of gain are not quite alike, and that there are faint indications of a future reaction.

Greater Number of Women.

The state of things here revealed is the more striking when compared with that existing in Europe. Both in the United Kingdom and on the continent the women are more numerous than the men. It is possible to detect forces that disturb the balance in some of these countries. But Mr. Porter, superintendent of the census or 1890, was inclined to think that these influences did not operate perceptibly in Austria and the Netherlands, and hence that normally the female sex outnumbers the male in nearly the proportion of 51 to 49. Comparison with the standard, then, makes the excess of males in America stranger than if nature exhibited strict impartiality.

The two forces which appear to be chiefly concerned in upsetting the equilibrium are war and immigration. And of the two the former is much the less effective. Still, it was powerful enough to influence the returns in Germany and France after the famous struggle of 1870-71. And in the United States it pulled down the male proportion of 5112 in every 10,000 in 1860 to 5056 in 1870.

Effects of Migration.

Migration, of course, works in two ways. The majority of immigrants are men. The departure from one country, therefore, leaves the other sex in excess in one part of the world, while they promote the preponderance of their own in another. Thus, in some European countries the proportion of males to females is about 485 to 515.

Now, inasmuch as three out of every five immigrants who come to the United States are men, and ten out of every seventy-five people here are of foreign birth, it is easy to see how important is this factor in establishing the ratio between the sexes. In 1890, for instance, the excess of males here was made up in this proportion: Native born, 628,797; foreign born, 884,713. And yet scarcely a seventh of the population came from other lands.

It is to this fact, no doubt, that immigration has experienced a slight check in the last few years, that the recent slight falling off in the masculine ascendency in America is due.

But people migrate not only from one country to another, but also from one

part of a country to another. This is peculiarly true in the United States. In consequence, there is a depletion of the ranks of the sterner sex in the East and a strong reinforcement in the West. Indeed, in the latter quarter there is a double invasion—from the more densely populated parts of our own land and from the old world. Hence the distribution of the sexes is not uniform.

Along the Atlantic seaboard for at least half a century there has been practically no excess of males, and, on the whole, a slight deficiency. The superabundance of women has been most conspicuous, though, in Massachusetts, Rhode Island and the District of Columbia. Just why there should be such a situation at the national capital is not clear. But in New England a special local agency has been at work—an influx of factory girls from Canada. Thus there is an occasional exception to the rule that the majority of immigrants are males.

As might be expected, the greatest excess of men is to be found in the far West, in the great agricultural and mining districts. In Minnesota and Nebraska there were at least 54 men out of every 100 people for a long time; from 55 to 58 in the Dakotas, and from 60 to 68 in most of the regions to the West and Southwest. The ratio in Montana was once as great as 81 out of 100, and even in 1890 was 66½ to 33½.

A slow, steady tendency toward equality has been observable, however, except in Utah, where the excess of men kept below the national average until 1880 and then increased only slightly. The connection between this fact and polygamy is too obvious to need pointing out.

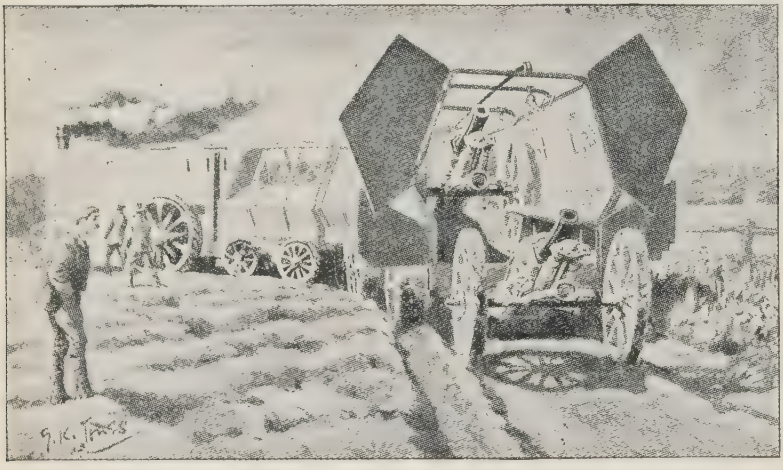
NOVEL TRACTION ENGINE

Quick Method of Transporting Heavy Guns—A Locomotive on Land.

WHEN Lord Roberts was in South Africa, he telegraphed to the War Office in London for a set of road engines and wagons sufficiently armored to withstand rifle fire, and sufficiently powerful to draw a couple of heavy guns, with their crews and ammunition. On these lines a train was designed and built, and, from a mechanical point of view, it has proved a complete success. For the design of the wagons credit belongs to the War Office itself, and especially to Captain Nugent, who is responsible for an ingenious contrivance which enables the loopholes to be opened partially or completely, or to be entirely closed, as the momentary conditions of a fight may require.

There is also an arrangement by which the sides can be either opened upwards or closed inwards, according to the purpose for which the wagon is being used.

If men are to occupy the wagon the sides are fixed in a vertical position, like the sides of a cattle truck, and the top is open to the sky. If, on the other hand, ammunition is to be carried, the sides can be bent inwards about a hinge till they meet, thus forming a complete cover, both bullet-proof and rain-proof. The new armored wagon may, in fact, be described as a "general carrier." It will carry men or ammunition, food supplies, or even guns, as shown in our picture.



ARMORED TRACTION ENGINE TRANSPORTING GUNS.

The train when tested was subjected to very severe trials. The route selected had been specially chosen because it offered a considerable variety of gradients. One long hill ascended was marked at the top with a caution to cyclists, but the road locomotive, with three heavy wagons and two howitzer guns, mounted the hill without any apparent difficulty. A long descent some miles further on gave an opportunity for testing the brake power, which appeared to be ample for any purpose.

A final test was to try the engine on soft ground. The driving wheels of the engine, seven feet in diameter and two feet broad, were fitted with projecting ridges to give them a grip of moderately soft ground. But the ground in the field was too soft, and the great wheels slipped round and round, churning up the loose earth and and making no progress. To increase their holding, "spuds," carried for the purpose, were clamped onto the wheels, but even with this addition the engine only succeeded in digging deeper into the ground, and was still unable to move forward. The soft earth gave way at each revolution of the wheel.

The engine was, therefore, cast loose from the trucks, and thus relieved of her load easily mounted the hill. She then uncoiled her cable, the end of which was made fast to the trucks, and as the cable was wound up the trucks and guns followed unresistingly. The difficulty had been overcome.

The complete order comprised six engines and twenty-four wagons. The armor, it should be added, consists of steel plates a quarter of an inch thick, specially hardened by the Cammell process. The plates will resist direct rifle fire at twenty yards, and are impervious to shrapnel or splinters of shell. Needless to say, however, they will not stand direct shell fire. One cannot help contrasting these engines, with their immense hauling power,

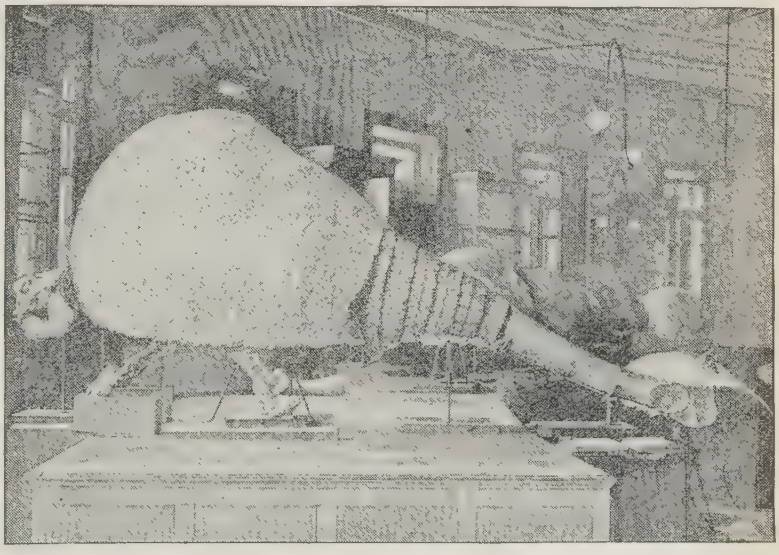
with the cumbrous ox-teams or horse-power method of traction which has often been the cause of great delay, vexation and trouble.

This method of transporting heavy guns simplifies one of the most formidable problems of modern warfare. Steam power will now be employed to do what before was done by horses and mules, and sometimes by men attached to the batteries. It is one of the many new devices for making war easy.

THE EXTINCT ARMADILLO

Huge Bone-Plated Animal—Curious Hoofs and Joints.

THE skeleton of this wonderful animal can be seen in the museum in Buenos Ayres, and was found in the pampas of Argentine Republic, which was the bottom of the sea in the early period of the earth's formation, and, consequently, contains many remains of the mammalia long since extinct. The name given by naturalists to this animal is glyptodon daedicurus.



SKELETON OF THE EXTINCT ARMADILLO.

It reminds one very much of our tortoise. A coat of mail covers the head, trunk and tail. By means of its six movable rings it is able to decrease its size. The limbs are very strong, and the prominent and enlarged joints show that the animal was very muscular. The plump, broad fore-feet contained each four toes, and the hind ones five toes, like a hoof, with large claws.

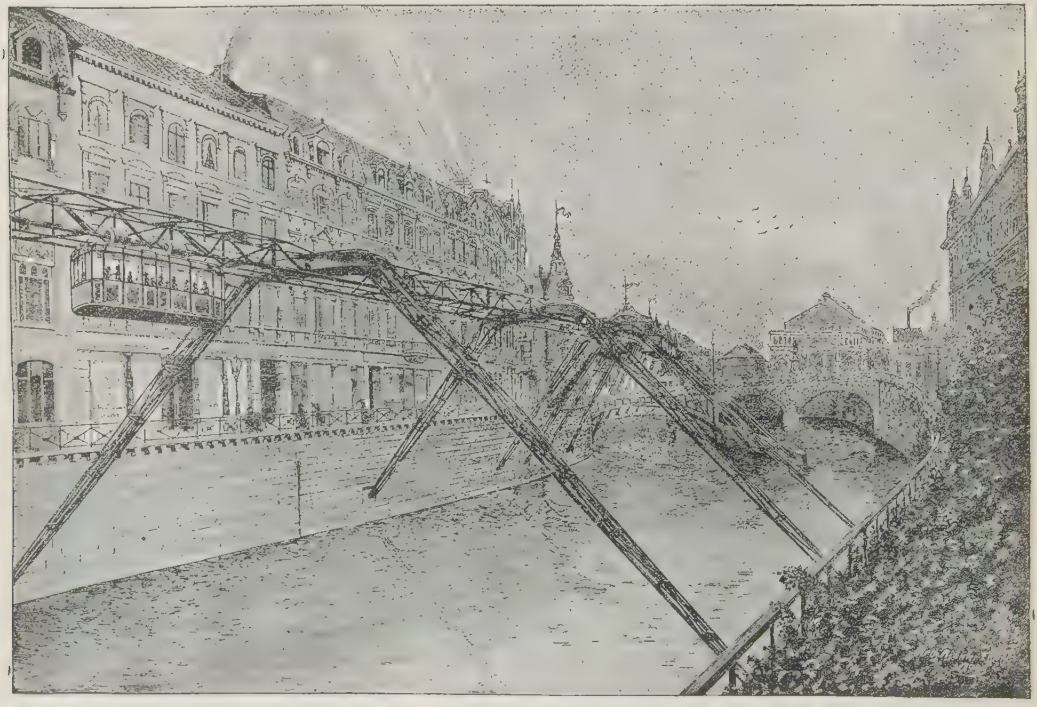
In spite of its muscular development, its locomotion was slow. As seen in the picture, each ring contains some circular joints which mark the place of hair or quills. According to the joints, the hair or quills must have been as thick as a

lead pencil, and from thirty to forty inches long. From the jaws and teeth it must have been a herbiverous animal. For what purpose it had the heavy coat of mail we are unable to tell, except that it may have been for self-protection.

THE ELECTRIC RAILWAY

Passengers Carried by Suspended Cars.

ELECTRICITY has come to be a great motive power. Once it was supposed that steam would never be superseded by any other force that man could use. For a long time there was no prospect that such would be the case, but of late years, and with remarkable rapidity, electricity has come to be the motive power for driving machinery. Not only has this natural force been brought into use for lighting purposes, and for conveying messages by telegraph and telephone, but it has been applied in a great variety of ways where steam was formerly used.



ELECTRIC RAILWAY BETWEEN ELBERFELD AND BARMEN, PRUSSIA.

It has even been said that the old and faithful horse is going out of use. This is not true, for so useful an animal will always have his work to do.

Great attention of late years has been paid to transportation within the confines of cities. Electricity is likely to be used more extensively for this purpose in the future than it is at the present time. Where steam was formerly used on elevated roads, this force must naturally give way to electric power, and the engines that create no nuisance by smoke from burning coal.

In Prussia there is a remarkable street railway, not laid over arches, but suspended from them, and the cars do not run upon the surface, but beneath. This is illustrated by the engraving which is here presented to the reader. The iron arches span a waterway. The suspended cars travel back and forth as easily as they would upon the surface. The means by which passengers enter and leave them are very simple, and the road is pronounced a success. Very likely other roads will be patterned after this, and this mode of conveying passengers will come into more general use than we find at the present time.

UNCLE SAM AS A BUSINESS MAN

UNCLE SAM has the longest civil list in the world. The exact number of his employes at any given time is hard to fix, because the number is continually changing, and the great aggregate is made up from so many sources.

Much has been written about Uncle Sam being a slow paymaster, and if your interest in his strong box is in the shape of a claim, and you are trying to collect it, then you will find that he fully lives up to his reputation. He is a mighty "close" customer when it comes to paying a claim.

But if he once puts you on his salary list, ah! Then you are fixed—that is, you are fixed for about a year, after which the "promotion" bee will begin to buzz in your bonnet. But once on the salary list, your claim against his exchequer is as good as wheat in the mill and the toll paid. He never pleads dull trade or overproduction or close competition as an excuse for scaling down wages or postponing any pay day. He never threatens to shut down the mills, and his hands never go on a strike.

It seems an incongruous thing to say, but hard times are an actual help to the

man with a Government salary. When times are hard and money scarce and trade dull, then things are cheap, and the stated salary will buy more.

Uncle Sam needs in his business the great army of people which he employs. He is engaged in various industries on a gigantic scale. He is engaged in making laws; in executing the laws; in administering justice; in manufacturing and selling postage stamps and carrying and delivering mails; in improving rivers and harbors; in diffusing knowledge among the people; in civilizing and instructing the Indians; in coining money; in building ships, and recently he has gone into the irrigation business and the colonial business, and he expects soon to enter upon the construction of a great canal.

Uncle Sam's law factory, if you will allow the term, is the greatest and most luxuriously appointed institution of that kind in the world.

Solons Who Draw Money.

The appropriation for the current fiscal year provides for ninety Senators the round sum of $45,000, and $45,000 for their mileage. Three hundred and sixty persons are employed to help these ninety statesmen, being four for each lawmaker, and for their salaries the sum of $515,000 is provided, being $20,000 more than the Solons themselves cost.

Four hundred and fifty persons all told make up the working force of this branch of Uncle Sam's law factory, at a total cost of $1,010,000 for salaries. Call it a round million, so long as Delaware does not fill her two places.

Some people have a vague idea that Senators are paid more than Representatives, which is a mistake. They are all paid alike, $5000 per year each. The Speaker of the House gets $3000 additional, and when a Senator fills the office of president of that body, as is now the case, he gets a like additional amount.

On the House side there are 357 members and 398 employes, making a total of 755, and the total for mileage and salaries amounts to the sum of $2,415.020.75.

Grand Total.

So the grand total for Uncle Sam's lawmaking establishment is 1205 legislators and their helpers, with a total salary list of $3,425,020.75. This does not include the cost of maintenance for the buildings and grounds, nor the salaries to clerks to the members of the House.

Uncle Sam has the finest library in the world, housed in the finest marble building ever designed for such purposes. For the current fiscal year it will take something more than 400 persons to attend to this great collection of books, serve the reading public and the members of Congress, and perform the work incidental to the proper care of the constant growth of the collection. They are on the pay roll for something near $500,000

Uncls Sam has a capital city of his own with about 300,000 inhabitants. It is said to be the finest city in this country and the best governed.

But it ought to be a well-governed city. Out of its 300,000 residents, one of every 100 is on the District pay roll. More than 3000, in one capacity or another, hold office under the District government. It has three Governors, who get $5000 per year each, Thirteen hundred teachers will teach its schools for the coming

year, for which they will receive $918,175. Seven hundred policemen will cost more than $700,000.

Nine United States Judges hold the courts of record, and ten Justices of the Peace draw each a salary equal to that of a Circuit Judge in the State court.

Cost of Courts.

In round numbers, it would cost Uncle Sam $2,500,000 for district salaries for the current fiscal year. This money he will take half out of one pocket and half out of the other—half out of the national treasury and half out of that of the district.

A large corps of judges administer justice in Uncle Sam's courts. Nine judges compose the Supreme Court of the United States, and their pay is $90,500 per year. Twenty-five circuit judges get $6000 per year each, and seventy-one district judges get $5000 per year each. Seven territorial judges get $5000 per year each, and fourteen territorial judges get $3000 per year each. Five judges for the Court of Private Land Claims are paid $5000; five for the Court of Claims at $4500; six for the Supreme Court of the District of Columbia at $5000, and three for the Court of Appeals for the District of Columbia at $6000.

Altogether it will cost Uncle Sam $768,500 to pay the salaries of his judges for the current fiscal year, and this will be only a small portion of the total cost of the administration of justice.

Uncle Sam's Chief Magistrate receives, as everybody knows, the annual salary of $50,000, and house rent free in the finest mansion in the land. Thirty-three helpers are provided for him this year, at a cost of $55,040. The President's right-hand man, his secretary, receives $5000 per annum, and the steward, the man who buys the food and administers the domestic affairs of the White House, gets $1800.

An army of people are on the pay roll in the departmental service proper in Washington. Altogether they will, since the great reduction in the Census Office, count up to about 25,000, and their salary list will amount to the round sum of $25,000,000.

Largest Item.

But now we are just coming to the biggest item in the long list of Uncle Sam's helpers. There are more employes in the postal service than in all the other branches combined. To nine-tenths of the people the postal service is the visible, tangible form of the Government. Few of us have business with the Treasury, the Interior Department or with any of the others, but the postal service touches the life of every one of us.

In round numbers 75,000 postmasters help Uncle Sam in carrying on this great business. Nineteen thousand clerks in offices of the first and second class render their assistance, and 18,000 city carriers distribute daily the mails from house to house, while 10,000 rural carriers perform daily the same service in the thickly populated country districts. Ten thousand railway postal clerks cover the country night and day over the great iron spider-web of railroad lines, gathering and distributing the mails as they fly.

An army of contractors and sub-contractors, operating daily and weekly schedules, penetrate the remotest and

most isolated communities, distributing them to another army of fourth class postmasters.

One hundred and six thousand, in round numbers, counting everybody, from the Postmaster General down to the postmaster in a fourth class office, with a salary of $1 per month, or even less, is the number of Uncle Sam's employes in the postal service. About 111,000 is the number in all the other branches of the civil service. About 271,000 is the grand total.

How are all these people paid? The process is simple enough. The postmaster pays himself out of the proceeds of stamps sold. His clerks are paid from the same source. So are the city carriers. Railway postal clerks are paid by the postmasters in certain central cities. The fourth class postmaster takes all of the first $50 of cancellations and a certain percentage of all cancellations above that. All these items are to be credited to his quarterly account current.

If the sale of stamps is not sufficient to meet all demands, he may transfer funds from his money order account. If there is not sufficient of this fund, he may secure authority from the Postmaster General to draw a draft upon the postmaster of New York, the postoffice of that city being the financial center of the system.

The emyloyes of the departments are paid monthly or semi-monthly by a disbursing officer in each bureau. They sign the pay roll and take their money in an envelope.

The President is the only one of Uncle Sam's employes who does not sign the pay roll. His salary is sent to him every month from the Treasury Department in the form of a Treasury warrant. It is taken over by a special messenger, and from the White House it is sent to one of the local banks and deposited to the credit of the President's private account. The warrant, when presented for collection, is taken up and cancelled, and goes into the files of the Department as a voucher for the treasurer.

The President gets $12,500 per quarter, but he does not get exactly a third of that sum each month. His monthly pay is computed by the Government salary book in the same manner as that of an ordinary clerk.

AMAZONS OF RUSSIA

THE Buriats are a Mongol race, with several branches, in East Siberia, on both sides of Lake Baikal, numbering about 208,000. They are a peace-loving but slothful and discourteous people, prone to petty thefts and passionately fond of drink. Though some have become good farmers, the majority are nomads, breeding cattle or living by hunting and fishing. Some of the tribesmen have of late years, however, studied with success several branches of science; and the blankets, leather and metal work of the people are known throughout Siberia. Those dwelling west of the lake have conformed to the Greek Church,

RUSSO-CHINESE FRONTIER: BURIAT AMAZONS ON A MOUNTAIN PATH.

and others have adopted Buddhism; but of most Shamanism is still the actual religion. Under Russian rule since 1664, they yet preserve among themselves a patriarchal form of government. Our illustration shows how these women travel on the almost impassable mountains.

There is a great difference in the social status of women in our own country and those in the far East. In Oriental nations and even among some of the countries of Europe, woman may truthfully be called the burden-bearer. She performs a great deal of the work which we naturally consider as belonging to man. Her condition is more like that of the squaws among American Indians, who hoe the corn, cut the wood, bring the water, and allow the noble Indian to lie in the shade and smoke his pipe.

The Buriat Amazons seen in the illustration are creatures of toil, according to the customs of the country. They are so masculine that, as will be noticed, they ride their steeds like men. The skill they display in guiding their steeds comes only from practice.

DISASTROUS CONFLAGRATIONS.

THE greatest destruction of life and property by conflagrations, of which the world has anything like accurate records, must be looked for within the last century. Of these the following is a list of instances in which the loss of property amounted to $3,000,000 and upward:

Dates.	Cities.	Property Destroyed.
1802	Liverpool	$ 5,000,000
1803	Bombay	3,000,000
1805	St. Thomas	30,000,000
1808	Spanish Town	7,500,000
1812	Moscow, burned five days; 30,800 houses destroyed	150,000,000
1816	Constantinople, 12,000 dwellings, 3000 shops	
1820	Savannah	4,000,000
1822	Canton, nearly destroyed	
1828	Havana, 350 houses	
1835	New York ("Great Fire")	15,000,000
1837	St. John, N. B.	5,000,000
1838	Charleston, 1158 buildings	3,000,000
1841	Smyrna, 12,000 houses	
1842	Hamburg, 4219 buildings, 100 lives lost	35,000,000
1845	New York, 35 persons killed	7,500,000
1845	Pittsburg, 1100 buildings	10,000,000
1845	Quebec, May 28, 1650 dwellings	3,750,000
1845	Quebec, June 28, 1300 dwellings	
1846	St. Johns, Newfoundland	5,000,000
1848	Constantinople, 2500 buildings	15,000,000
1848	Albany, N. Y., 600 houses	3,000,000
1849	St. Louis	3,000,000
1851	St. Louis, 2500 buildings	11,000,000
1851	St. Louis, 500 buildings	3,000,000
1851	San Francisco, May 4 and 5, many lives lost	10,000,000
1851	San Francisco, June	3,000,000
1852	Montreal, 1200 buildings	5,000,000
1861	Mendoza, destroyed by earthquake and fire, 10,000 lives lost	
1862	St. Petersburg	5,000,000
1862	Troy, N. Y., nearly destroyed	
1862	Valparaiso, almost destroyed	
1864	Novgorod, immense destruction of property	
1865	Constantinople, 2800 buildings burned and many lives lost	

Date.	Place.	Property Destroyed.
1866	Yokohama, nearly destroyed.....	
1865	Carlstadt, Sweden, all consumed but Bishop's residence, hospital, and jail; 10 lives lost.....	
1866	Portland, Me., half the city.....	11,000,000
1866	Quebec, 2500 dwellings and 17 churches.....	
1870	Constantinople, Pera suburb	26,000,000
1871	Chicago, 250 lives lost, 17,430 buildings burned, on 2124 acres	192,000,000
1871	Paris, fired by the Commune	160,000,000
1872	Boston.....	75,000,000
1873	Yeddo, 10,000 houses....	
1877	Pittsburg, caused by riot.....	3,260,000
1877	St. Johns, N. B., 1650 dwelling, 18 lives lost	12,500,000
1889	Seattle, Wash.....	20,000,000

From the above it appears that the five greatest fires on record, reckoned by destruction of property, are:—

Chicago fire, of Oct. 8 and 9, 1871.....	$192,000,000
Paris fires, of May, 1871.....	160,000,000
Moscow fire, of Sept. 14–19, 1812.....	150,000,000
Boston fire, Nov. 9–10, 1872..	75,000,000
Hamburg fire, May 5–7, 1842	35,000,000

Taking into account, with the fires of Paris and Chicago, the great Wisconsin and Michigan forest fires of 1871, in which it is estimated that 1000 human beings perished and property to the amount of over $3,000,000 was consumed, it is plain that in the annals of conflagrations that year stands forth in gloomy pre-eminence.

CHICAGO'S GREAT FIRES.

There were 2100 acres of land burned over, nearly all of which area was thickly covered with buildings. There were nearly 18,000 buildings destroyed, of which about 2400 were stores and factories; and there were but few short of 100,000 people rendered homeless by the calamity. The extreme length of the burnt district was three and three-fourths miles and its greatest width a little over a mile. The fire of July, 1874, originated on South Clark street, spreading to Michigan avenue. It was estimated that in this fire about fifty acres were burned over, many of the new buildings which had been erected after the great fire of 1871 having been leveled.

The loss of property in the great fire of 1871 was $192,000,000, after allowing $4,000,000 for salvage on foundations of buildings. This estimate does not include the shrinkage of real estate values or the large loss to mercantile interests by the interruption of the trade consequent upon the destruction of stocks and business facilities. Mr. Colbert estimated the grand aggregate not very much below $290,000,000. The loss occasioned by the fire of 1874 was estimated as follows: The net loss to insurance companies was officially placed at $2,244,970, or 40 per cent. of the entire loss, making an estimated total loss of $5,612,425.

HIGHEST MOUNTAINS.

Kunchainyunga, Himalayas	28,170	Mt. Hood, Oregon	11,570
Sorata, Andes	25,380	Simplon, Alps	11,542
Illimani, Bolivia	21,780	Mt. Lebanon, Syria	11,000
Chimborazo, Ecuador	21,444	Mt. Perdu, France	10,950
Hindoo-Koosh, Afghanistan	20,600	Mt. St. Helen's, Oregon	10,158
Cotopaxi, Ecuador	19,408	Mt. Etna, Sicily	10,050
Antisana, Ecuador	19,150	Olympus, Greece	9,754
St. Elias, British America	18,000	St. Gothard, Alps	9,080
Popocatapetl, Mexico	17,735	Pilate, Alps	9,050
Mt. Roa, Hawaii	16,000	Mt. Sinai, Arabia	8,000
Mt. Brown	15,900	Pindus, Greece	7,677
Mount Blanc	15,776	Black Mountain, New Caledonia	6,467
Mowna Roas, Owhyhee	15,700	Mt. Washington, New Hampshire	6,234
Mt. Rosa, Alps, Sardinia	15,550	Mt. Marcy, New York	5,467
Pinchinca, Ecuador	15,200	Mt. Hecla, Iceland	5,000
Mt. Whitney, Cal	15,000	Ben Nevis, Scotland	4,400
Mt. Fairweather, Alaska	14,796	Mansfield, Vermont	4,280
Mt. Shasta, Cal	14,450	Peaks of Otter, Virginia	4,260
Pike's Peak, Colorado	14,320	Ben Lawers, Scotland	4,030
Mt. Ophir, Sumatra	13,800	Parnassus, Greece	3,950
Fremont's Peak, Wyoming	13,570	Vesuvius, Naples	3,932
Long's Peak, Cal	13,400	Snowdon, England	3,500
Mt. Ranier, Washington	13,000	Stromboli	3,850
Mt. Ararat, Armenia	12,700	Ben Lomond	3,280
Peak of Teneriffe, Canaries	12,236	Mt. Carmel	2,000
Miltson, Morocco	12,000	Gibraltar	1,470

LARGEST PARK IN THE WORLD.

The Yellowstone National Park extends sixty-five miles north and south and fifty-five miles east and west; comprising 3575 square miles, and is 6000 feet or more above sea-level. Yellowstone lake, twenty miles by fifteen, has an altitude of 7788 feet. The mountain ranges, which hem in the valleys on every side, rise to the height of 10,000 to 12,000 feet and are always covered with snow. This great park contains the most striking of all the mountains, gorges, falls, rivers and lakes in the whole Yellowstone region.

The springs on Gardiner's river cover an area of about one square mile, and three or four square miles thereabout are occupied by the remains of springs which have ceased to flow. The natural basins into which these springs flow are from four to six feet in diameter and from one to four feet in depth. The principal ones are located upon terraces midway up the sides of the mountain. The banks of the Yellowstone river abound with ravines and canyons, which are carved out of the mountains through the hardest rocks.

The most remarkable of these is the canyon of Tower Creek and Column Mountain. The latter, which extends along the eastern bank of the river for upward of two miles, is said to resemble the Giants' Causeway. The canyon of Tower Creek is about ten miles in length, and is so deep and gloomy that it is called "The Devil's Den." Where Tower Creek ends the Grand Canyon begins. It is twenty miles in length, impassable throughout, and inaccessible at the water's edge, except at a few points. Its rugged edges are from 200 to 500 yards apart, and its depth is so profound that no sound ever reaches the ear from the bottom.

The Grand Canyon contains a great multitude of hot springs of sulphur, sulphate of copper, alum, etc. In the number and magnitude of its hot springs and geysers, the Yellowstone Park surpasses all the rest of the world. There are probably fifty geysers that throw a column of water to the height of from 50 to 200 feet, and it is stated that there are not fewer than 5000 springs; there are two kinds, those depositing lime and those depositing silica.

SINGULAR FORMATION CALLED THE SPONGE, IN YELLOWSTONE PARK.

The temperature of the calcareous springs is from 160 to 170 degrees, while that of the others rises to 200 or more. The principal collections are the upper and lower geyser basins of the Madison river and the calcareous springs on Gardiner's river. The great falls are marvels

to which adventurous travelers have gone only to return and report that they are parts of the wonders of this new American wonderland.

HEIGHT OF PRINCIPAL MONUMENTS AND BUILDINGS.

Places.	Feet.	Places.	Feet.
Paris, Eiffel	1000	Lombardy, Cathedral of Milan	355
Washington, D. C., Washington Monument	555	Holland, Cathedral of Utrecht	356
Philadelphia, Public Buildings	535	Egypt, Pyramid of Sakkarah	356
Cologne, Cathedral	525	Bavaria, Cathedral of Notre Dame, Munich	348
Egypt, Pyramid of Cheops	486	Venice, St. Mark's Church	328
Belgium, Antwerp Cathedral	476	Italy, Assinelli Tower, Bologna	272
France, Strasburg Cathedral	474	New York, Trinity Church	284
Egypt, Pyramid of Cephrenes	456	Hindostan, Column at Delhi	262
Rome, St. Peter's Church	448	China, Porcelain Tower, Nankin	260
Germany, St. Martin's Church, at Landshut	411	Paris, Church of Notre Dame	224
England, Salisbury Cathedral	400	Massachusetts, Bunker Hill Monument;	221
England, St. Paul's Church, London	365	Italy, Leaning Tower of Pisa	179
Italy, Cathedral at Florence	386	Baltimore, Washington Monument	175
Lombardy, Cathedral at Cremona	397	Paris, Monument, Place Vendome	153
Germany, Church at Fribourg	386	Italy, Trojan's Pillar, Rome	151
Spain, Cathedral of Seville	360	Paris, Obelisk of Luxor	110

THE WASHINGTON MONUMENT.

The corner-stone was laid by President Polk, July 4, 1848, and December 6, 1884, the capstone was set in position. The foundations are 126½ feet square and 36 feet, 8 inches deep. The base of the monument is 55 feet, 1½ inches square, and the walls 15 feet, ¼ inch thick. At the 500-foot mark, where the pyramidal top begins, the shaft is 34 feet, 5½ inches square and the walls are 18 inches thick.

The monument is made of blocks of marble 2 feet thick, and it is said there are over 18,000 of them. The height above the ground is 555 feet. The pyramidal top terminates in an aluminum tip, which is 9 inches high and weighs 100 ounces. The mean pressure of the monument is 5 tons per square foot, and the total weight, foundation and all, is nearly 81,000 tons. The door at the base, facing the Capitol, is 8 feet wide and 16 feet high, and enters a room 25 feet square. An immense iron framework supports the machinery of the elevator, which is hoisted with steel wire ropes two inches thick.

At one side begin the stairs, of which there are fifty flights, containing 18 steps each. Five hundred and twenty feet from the base there are eight windows, 18x24 inches, two on each face. The area at the base of the pyramidal top is 1,187¼ feet, space enough for a six-room house, each room to be 12x16 feet.

The Washington Monument is the highest in the world except the temporary Eiffel Tower. Externally the monument is complete, but to complete the interior will be the work of time. When done the total cost will aggregate not far from $1,500,000. It is an object of great interest to visitors at the capital.

SIZE OF LAKES, SEAS AND OCEANS.

Lakes.	Miles Long.	Miles Wide.
Superior	380	120
Michigan	330	60
Ontario	180	40
Champlain	123	12
Erie	270	50
Huron	250	90
Cayuga	36	4
George	36	3
Baikal	360	35
Great Slave	300	45
Winnepeg	240	40
Athabasca	200	20
Maracaybo	150	60
Great Bear	150	40
Ladoga	125	75
Constance	45	10
Geneva	50	10
Lake of the Woods	70	25

Seas.	Long.
Mediterranean	2,000
Caribbean	1,800
China	1,700
Red	1,400
Japan	1,000
Black	932
Caspian	640
Baltic	600
Okhotsk	600
White	450
Aral	250

Oceans.	Square Miles.
Pacific	80,000,000
Atlantic	40,000,000
Indian	20,000,000
Southern	10,000,000
Arctic	5,000,000

DEEPEST LAKE IN THE WORLD.

In the Cascade Mountains, about seventy-five miles northeast of Jacksonville, Ore., the seeker for the curious will find the Great Sunken Lake, the deepest lake in the world. This lake rivals the famous valley of Sinbad the Sailor. It is said to average 2000 feet down to the water on all its sides. The depth of the water is unknown, and its surface is as smooth and unruffled as a mammoth sheet of glass, it being so far below the mountain rim as to be unaffected by the strongest winds. It is about fifteen miles in length and about four and a half wide. For unknown ages it has lain still, silent and mysterious in the bosom of the great mountain range, like a gigantic trench, scooped out by the hands of a giant genie.

LONGEST TUNNELS IN THE WORLD.

The Mount St. Gothard Tunnel, Italy, is 48,840 feet long, the longest in the world.

Mount Cenis Tunnel, Italy, is 39,840 feet long, or about seven miles long.

Hoosac Tunnel, Mass., is 25,080 feet long, or about four and one-half miles.

The Nochistongo Tunnel is 21,659 feet long, or about four miles.

The Sutro Tunnel is 21,120 feet long, or four miles.

Thames and Medway Eng., is 11,880 feet long, or about two miles.

CAPACITY OF THE LARGEST CHURCHES AND HALLS.

The figures refer to the number of persons the buildings will contain:

St. Peter's Cathedral	Rome	54,000
Cathedral of Milan	Milan	37,000
St. Paul's Church	Rome	32,000
St. Paul's Cathedral	London	25,000
Church of St. Petronia	Bologna	24,000
Cathedral of Florence	Florence	24,000
Cathedral of Antwerp	Antwerp	24,000
Mosque of St. Sophia	Constantinople	23,000
St. John's Lateran	Rome	22,000
Cathedral of Notre Dame	Paris	21,000
Cathedral of Pisa, Pisa		13,000
Church of St. Stephen, Vienna		12,000
Church of St. Dominic, Bologna		12,000
Church of St. Peter, Bologna		11,400
Cathedral of Vienna, Vienna		11,000
St. Peter's Cathedral, Montreal		10,000
Madison Square Garden, N. Y.		8,433
Auditorium, Chicago		8,000
Academy of Music, Philadelphia		2,865
Theatre Carlo Felice, Genoa		2,560
Boston Theatre, Boston		2,972
Covent Garden, London		2,684
Academy of Music, New York		2,526
Music Hall, Boston		2,585
Alexander Theatre, St. Petersburg		2,332
Opera House, Munich		2,307
San Carlos Theatre, Naples		2,240
Imperial Theatre, St. Petersburg		2,160
Grand Opera, Paris		2,090
La Scala, Milan		2,113
St. Charles Theatre, New Orleans		2,178
Opera House, New Orleans		2,052
Grand Opera House, New York		1,883
McVicker's Theatre, Chicago		1,790
Ford's Opera House, Baltimore		1,720
Opera House, Berlin		1,636

ELECTRICITY

Discoveries That Have Puzzled Our Age—Practical Uses of this Subtle Force in Nature—Thomas A. Edison and His Inventions.

ELECTRICIANS are the wizards of modern times. They move in mysterious ways, and perform what the ordinary tax-paying citizen and his son are pleased to call "wonders." Their very shop talk is full of mysterious words. They have a craft language all their own. Get two or three of them together and the air bristles with talk about "boosters," "monocyclic triaphase transformers," "sinusoidal waves," "magneto-motive force," and other things never heard of in ordinary walks of life.

The very bills which the electric light

companies send out are mysterious, as are the meters which are supposed to furnish a reasonable excuse to the company for sending out the monthly bills. The ordinary citizen can generally figure out a proposition in which feet, inches or pounds come into play, but he bows to the mystic and takes off his hat to black art when a monthly bill figures out kilowatts, amperes, etc., comes to him through the mails.

What Is It?

The electrician, however, has a good reason for wearing this cloak of mystery, for he is dealing with a deep, impenetrable mystery himself. He does not know what electricity is and will admit it when driven into a corner.

That which we call electricity is the scientific "what is it?" It is called a fluid and also two fluids, a flux, a form of energy, an effluvia, a kind of molecular disturbance and etheric vibrations. But what is it, where it comes from, where it goes to and how it moves so rapidly are questions which remain unanswered. It is a great big interrogation point and there are some candid scientists who declare the mystery never will be solved.

While no man can say, "I know what electricity is," and prove it, the generally accepted theory is that that which we call electricity is a form of etheric vibration, akin to light, heat and magnetism. It is assumed that all space is filled with something and that something is called ether. This ether, it is assumed, is a substance which, while it is infinitely more rare, more subtle than air, is incompressible. This ether, if the theory is correct, is more rigid than steel and yet so extremely light that it penetrates solids, even the molecules of matter. Because of its rigidity this ether, say the theorists, can transmit waves of vibration with inconceivable rapidity.

Certain forms of such vibrations, say the scientists, are heat, other forms are light, and other forms are electricity. In short, this theory assumes all matter to be in a perpetual state of vibration and the developments in the electrical world, the recent successes of wireless telegraphy, the wonders of the X-rays, the newest inventions and the latest discoveries in light, heat and electricity seem to realize the ideals ventured by the bold advocate of the etheric vibration theory.

Amazing Calculations.

To accept this theory one must close his eyes to the commonplace. He must give his imagination not only free rein, but he must let it run away with itself. He must work himself up to a condition of mental abandon for his brain must wrestle with figures which run far up into the hundreds of trillions, unthinkable numbers.

Just how the men of theories arrived at the guess that if ether waves or vibrations travel at the rate of 500,000,000,000,000 a second the effect is heat; if they come at a higher frequency the effect is light, is known only to themselves—it is not for the uninitiated to know. But this is the way they figure out the difference between heat and light and the chemical action caused by the radiant energy sent out by the sun.

But the electrician does not balk at these processions of ciphers. He uses them in his business, and, as his time is valuable, he has invented an abbreviated

form to express such figures. The "ohm" is the unit of electrical resistance. Some substances, like gutta-percha, for instance, offer such resistance to the electrical current that to show this coyness on paper requires the use of a number having eighteen figures. So the inventive electricians arranged a system of prefixes to "ohm"

COMPLETING THE ELECTRIC STAR SURMOUNTING THE PALACE OF ELECTRICITY, PARIS EXPOSITION.

which permits them to riot in incomprehensible figures without being compelled to count the array of ciphers to be certain they have penciled enough of them. Thus 1,000,000 ohms is written megohm, 1,000,000,000 is begohm, 1,000,000,000,000 is tregohm and 1,000,000,000,000,000 a quegohm.

Practical electricians, however, spent little time in worrying over the question, "What is electricity?" They know what the electric current will do; they know the effects if they do not understand the cause. They have succeeded in learning just how much work they can get out of an electrical current. They have completely mastered the details of the effects of the work done. Electricity cannot be seen; it is noiseless; it cannot be weighed, yet it can be measured, urged, restrained, divided, collected, stored, and generally can be handled as though it were a visible, portable, tangible kind of matter.

The electricians know that if a circle of wire is passed in the air near a magnet that a current of electricity flows through the wire. They know that if they can arrange loops of wire in a form which can be revolved at high speed in the magnetic field which, it is assumed, extends around the poles of a magnet, that a powerful current of electricity will be "produced," or, as they say, "generated." They know that if they wind some wire round a piece of soft iron and then send a current of electricity through the wire that the soft wire at once becomes a magnet. They know then that etectricity will "produce magnetism" under certain conditions, and that in turn magnetism will "produce" electricity. These things they know, for their daily bread-winning work has proved that such things are.

So it is that electricians have made machines which generate electricity; which supply the useful current that makes the electric arc; that sends the trolley car speeding through our streets; that operates motors which transmit energy and motion used in ten thousand different ways, and that enables the Jack Tars to

"pick up" with the powerful searchlight ships and boats at sea in the darkest nights.

Thomas A. Edison once was asked to give his answer to the question: "What is electricity?" He replied:

"I don't know, for I am not an electrician. I am a mechanic who happens to know that under certain conditions and with certain guiding appliances the electric current will do certain things. I simply utilize the work of electricity just as an engineer will utilize the work-giving properties of live steam. He doesn't know exactly what steam is. He knows that if water is heated in a closed boiler and is made hot enough that what he calls steam operates his engine. If you tell him it is not the steam, but heat, that does the work, he cannot successfully prove that you are wrong.

Power of Heat.

"As a matter of fact, it is heat in the steam which gives steam its expansive properties. The steam, the vaporized water, is simply the vehicle which carries the heat to the point where the work is accomplished. Now, that is the way I look at electricity. The current, if it is a current, is a movement of something which I know will give me certain results under certain conditions. All I have to do is to meet the requirements and I will surely accomplish my planned results."

So when you get down to first principles the only mysterious thing about electricity is electricity itself. Just take it for granted that it is the waves or vibrations of the ether; that these waves started at one end of a wire will pass through or over this wire to the other end, provided there is some path made to bring the waves back to the starting point; that in their passage the waves start like waves or vibrations, and the rest of all that is electrical or magnetic is easy to understand.

This is about the way the practical electrician puts the case:

Must Be a Current.

"The cause which produces an electrical current is called an electromotive force. Every source of electricity, whether it is a dynamo, an electric battery or a frictional electric machine, must first produce the electromotive force before it can start the electric current. Unless it is producing a current this electromotive force is not doing work. In a dynamo this electromotive force is produced by the rotation of coils of wire wrapped on the armature of the machine through the space between the poles of the field magnet. In the battery or voltaic cell this electromotive force is produced by the chemical action of an acid charged liquid on two different metals. This frictional electric machine produces electromotive force when the glass plate or cylinder of the machine is rubbed against a leather cushion.

"Now this electromotive force is electric pressure, and it is the electric pressure which sends the electric current through a conductor or wire. While the current is passing through the wire the electromotive force is doing work. This electric current transmits energy or power. To produce an electromotive force work must be done. Thus if the electric source is a dynamo coal must operate an engine and the engine must operate the dynamo.

"If the current is directed along the

wire to an electric motor, the motor transforms the electrical current into rotary motion and this motion actuates machinery. If the current is carried by wires to the carbons of an arc light the resistance of the air space between the carbon points to the passage of the current transforms the electric energy to heat and light. If the electric current is led to electroplating baths the current is transformed into a chemical action, which causes metals to be deposited on properly treated objects.

"If the electrical current flows at a uniform rate in one direction it is called a continuous current, and if it flows back and forth it is called an alternating current. The alternating current is generally used for incandescent and arc lighting and for electric transmission of power."

Some day, perhaps, we will know what electricity really is. Some day, perhaps, we will know why a sluggish electric current flowing through the primary coil of an induction coil starts up currents full of ginger and snap in the finer wires of the secondary coil. Some day, perhaps, we will know what makes the difference between the electricity which sends off snapping sparks from an electric machine and that which flows from a battery or dynamo.

Some day, perhaps, we will know just what is the difference between magnetism and electricity. But until then the practical electricians will seek to use the effects, the manifestations of electricity for the good of mankind, leaving to the theorist and investigating scientist the work of seeking the path which leads back from the effect to the cause.

EDISON'S LATEST TRIUMPH—PROCESS PERFECTED SO THAT SUBSTANCES MAY BE COATED WITH VAPORS OF GOLD.

THOMAS A. EDISON has achieved another of his wonderful inventive triumphs. After working incessantly for eight years, he has perfected his "vacuum depositing process" for vaporizing gold and other metals.

The first effect of the new invention has been the revolutionizing of phonograph cylinder manufacture. On the first of February, 1902, the big phonograph works belonging to Edison at Llewellyn, N. J., began making records by the new process. It may now be said that the perfect phonograph is an assured fact.

But the new process does not confine itself to phonographic cylinder production. It enters into some of the widest fields of commercial endeavor. Edison will soon be making mirrors coated with gold and with silver, and gold-plated window panes and lamp globes. It will be possible before long to buy gold lace (apparently genuine) at five cents a yard.

The new phonograph cylinders are made with vapor of gold. The phonograph is now almost a perfect instrument. New records have none of the Punch-and-Judy twang which made the old ones so objectionable. One record cylinder is as good as another, each reproduction being as perfect as the "master record" which forms its original.

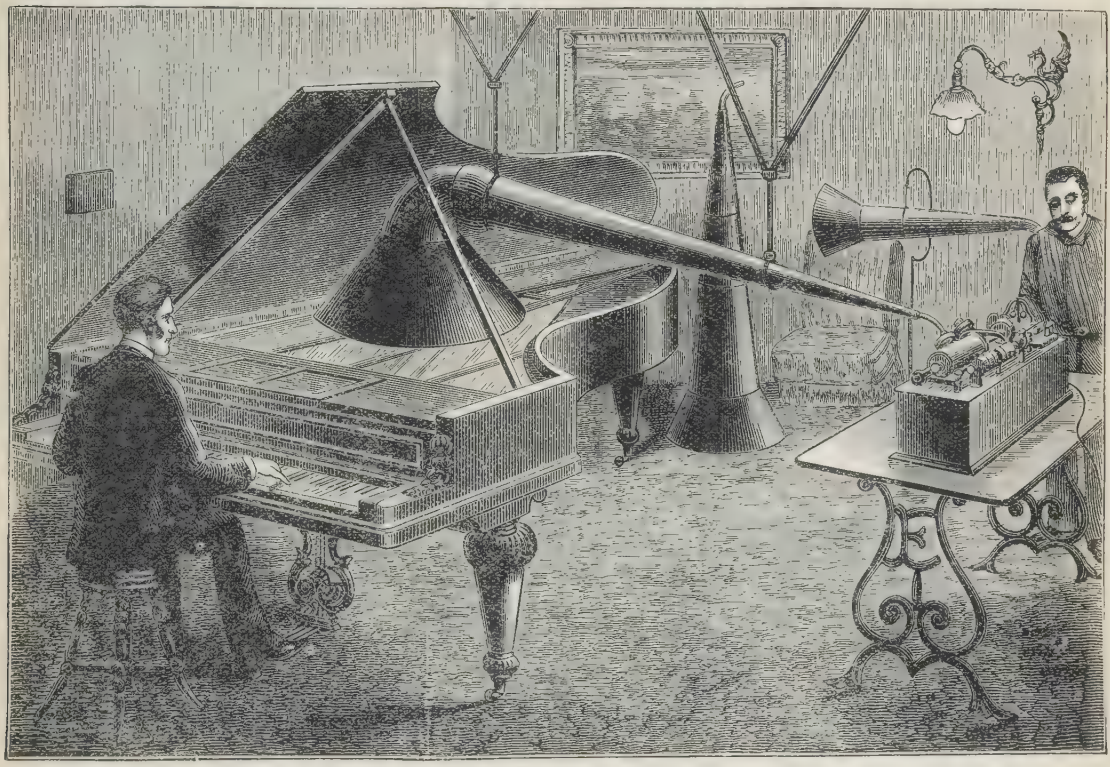
Employing the old method, it was necessary to get one good record, termed the "master," and then, from that, others were made by a process of duplication on

double phonographs. This duplicating process consisted in setting the master-record on a machine like a phonograph, and then placing another cylinder, having a clean, unmarked record on it, beside it. A fine point fitted into the master-record, the other end of which cut into the receiving cylinder. Thus the master-record was literally traced by mechanicaal means upon the new record.

This cutting of one cylinder into another was necessarily attended with many imperfections. In the first place, the little knives that did the cutting into the wax were always wearing out, even though Edison made them with blades of sapphire.

Under the most favorable conditions, it was difficult to obtain more than fifty per cent. of the sound which came from a master-record. Besides, the duplicates were of varying degree of perfection, some being fair representations of the "master," others poor imitations.

These deficiencies were caused by the divergent conditions of the work. It was almost impossible to obtain a mechanically exact reproduction of the first record. The duplication process was also, of course, extremely slow. Working at full capacity, the machines were seldom able to turn out more than thirty records taken from a master-record in one day.



PIANO MAKING A RECORD ON THE PHONOGRAPH.

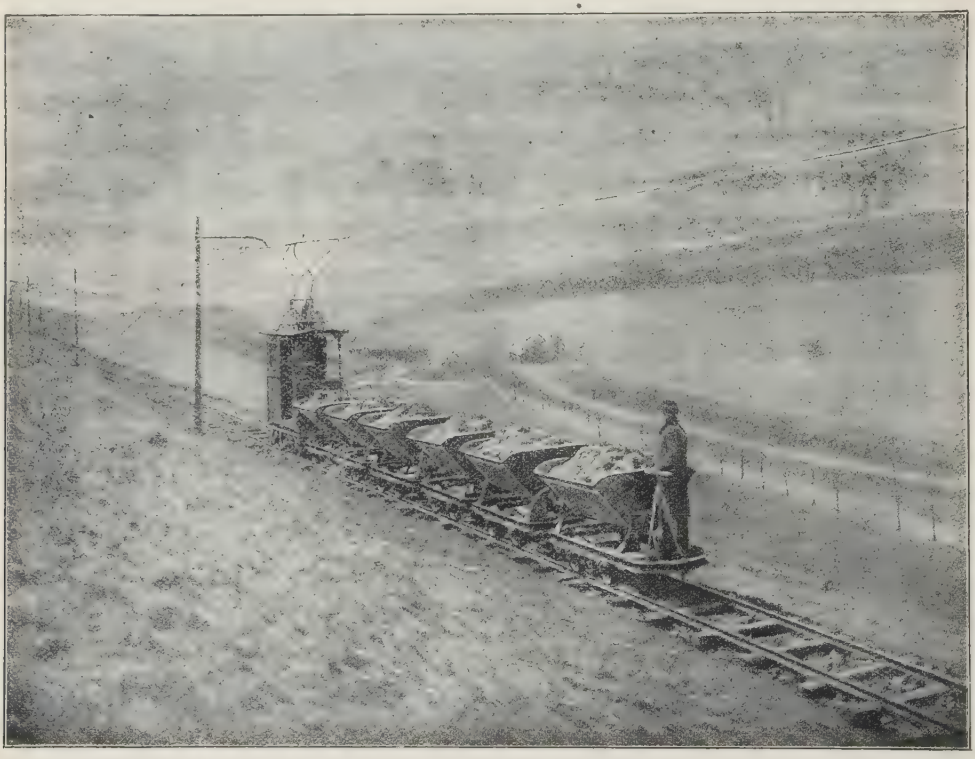
The making of a phonographic record is not one of the easiest things imaginable. Hundreds of little things have to

be looked after. In the first place, a cylinder is not really wax, as is popularly supposed. It is a species of soap, which, however, unlike ordinary soap, is not affected by water. The cylinders being ready for receiving their sound impressions, records are taken on them. Regular artists come to the phonograph works to sing, or play, into the phonographs.

The new Edison process is this: When the master-record has been made, it is placed in a vacuum. It is held up in the vacuum receptacle by a sort of core. Into this vacuum two wires are introduced, one connected with the positive, the other with the negative pole of a battery. These wires are of gold, and gold strips are in the vacuum in contact with each wire.

The record-cylinder is so placed that it can be rapidly rotated by magnets placed on the outside of the vacuum case. When the electricity is turned on, and the wires charged, gold vapor is given off from both wires and strips. This vapor strikes against the rapidly-turning record cylinder, and very soon, on the face of the cylinder, may be seen a deposit of gold in a very thin sheet.

The cylinder looks as if it had been out in a golden mist and become saturated with golden moisture. The fine vapor of gold is thus driven into all the little dents and markings—even the minutest—on the phonograph master cylinder. The gold is so fine that it actually coats the cylinder, as if it were water.



TRANSPORTING IRON ORE BY AN ELECTRIC RAILROAD.

When there is a sufficient deposit of gold on the cylinder, it is taken out and placed in a copper bath. A deposit of copper one-sixteenth of an inch in thickness is electro-plated on the surface of the gold. The object in putting on the copper is to keep the gold from breaking down when other records are taken from the metal cylinder, which forms thus a species of matrix or mould.

Having the metal matrix, all that is now necessary in order to obtain a record from it is to bring its surface in contact with molten wax. As any substances placed in the Edison vacuum become covered by gold vapor, the inventor has succeeded in producing some exquisite gold lace, made by merely suspending pieces of cotton lace in the vacuum cylinder. The process, while seemingly very simple, has occupied eight years of the inventor's best thought.

ELECTRICITY AS A MOTIVE POWER.

There is no power or force of energy which is so practical as electricity. That is the reason why it is used in nearly all branches of the various trades, science and art. It is a fact that most of the mines are operated with electricity. The field is worked with electricity and trains are run by this power.

Electricity can be had from various sources. Machinery has been constructed that produces it, but recently water-falls and other forms of nature's power have been used. Even wind-mills are used to generate this power.

Especially for mountain travel are electric engines adapted; they are far superior to the steam engine. It seems that the steeper the hill to climb the easier an electric engine runs, and they are cleaner and have an elegant appearance.

CAPITAL OF GERMANY

BERLIN, the capital of Prussia, and since 1871, of the German Empire, the chief residence of the Emperor of Germany, the seat of the German Reichstag and Prussian Landtag, and the third largest city in Europe, is situated on the Spree. The city is built upon a flat, sandy plain, which, though cultivated, is far from being fertile. Its average height above the level of the Baltic is only 100 feet.

The Spree, here, about 200 feet wide, with a current so sluggish as scarcely to be perceptible, flows through the city, dividing it into two nearly equal parts, and communicating with the Oder and the Baltic by canals. The inconvenience of its low-lying situation in the midst of the sandy flats of Brandenburg is more than made up for by the great geographical advantages of its position in the heart of northern Germany.

The commerce and manufactures of Berlin have increased so rapidly of late years, that it now ranks among the most important mercantile places of Continental Europe. The traffic is carried on by the Spree, the canals and numerous railways, of which the intra-mural or "city railway," opened in 1882, has a length of seven miles and passes through the middle of the city from east to west, and through the suburban or "ring railway," twenty-three miles long, forms a complete circle around its outskirts. The traffic by water is 50 per cent. greater than that of any island town of Germany. The staple commodities are grain, cattle, spirits, and wool. The Exchange, daily visited by 3500 persons, is the centre of the North German money market.

The Reichsbank is the chief bank in Germany for the issue of notes. It has $30,000,000 of paid up capital, and 218 branch offices. The principal branches of industry are woolen-weaving, calico-printing, and the manufacture of engines and other machinery (for which there are now over 100 establishments), also of iron, steel, and bronze wares, drapery goods, and confections.

Of ladies' mantles alone Berlin produces annually $25,000,000 worth (two-thirds for export trade). It has also very important manufactures of railway and other carriages, sewing machines, safes, telegraphic apparatus, scientific instruments, chronometers, steel pens, and jewelry.

NEW RAILWAY STATION IN BERLIN.

Of the other industries of Berlin the chief are its manufacture of pianofortes (of which the four largest manufactories turn out as many as 6000 in a year), accordions (of which Berlin is the main source of supply for the foreign trade), and other musical instruments; hardware,

German silver, lamps, and metal toys; leather, paper, rubber, soap, and chemicals; furniture, carpets, porcelain and other earthenware; gloves, linen articles, straw hats, and artificial flowers.

The silk trade alone appears to have fallen off of late years. Of beer, over 50,000,000 gallons are brewed every year, the malt tax for one year amounting to nearly $500,000. Most large enterprises are now carried on by joint-stock companies, although a number have in recent years ended in disaster, with great loss to the shareholders. In respect of its publishing trade, Berlin now shares with Leipzig the first rank amongst German cities.

An accompanying illustration represents one of the favorite sports in Germany. We find skating in all countries where there is ice, and the Germans are fond of this amusement. Not only do they have ice boats fitted up with sails, but it is customary for two or three skaters to provide themselves with canvas stretched and fastened to poles, which enables the skaters, when their is a stiff breeze, to make very rapid progress on the ice, sometimes going at the rate of three-fourths of a mile a minute. Thus lively winter scenes are witnessed on the rivers and out door sports are popular and, of course, healthful.

SPORT ON THE ICE IN GERMANY.

The ice boat seen in the engraving is similar to those often witnessed on the Hudson river. With a stiff breeze they attain very great speed and the sport is very enjoyable.

DANGEROUS CIRCUS FEAT

The Fall of Equestrian Corradini—Courage of Man and Beast.

THE strong competition at present existing in all walks of life compels each and every one to greater exertions, especially those who appear in public, from the Minister of State to the equestrian performer. Among the performers who sprung into fame was Corradini. In the Circus Busch, Berlin, he introduced a feature, seen there for the first time. Upon a board attached to a balloon, with his horse Blondin, he ascended to the ceiling of the building. The descent was not a slow one, but a very quick one, thereby assuming an apparent fall. The courage of both man and horse was marvelous.

REMARKABLE CIRCUS FEAT: CORRADINI'S RAPID DESCENT ON HORSEBACK.

After continued triumphs in Paris and Copenhagen, Corradini reached the city of Gotenburg, in Sweden, and there met with a terrible catastrophe. Upon that luckless day, in the Cirque du Nord, under the management of Costa, the ascent was made in safety. The building was packed and the audience, almost breathless, gazed in silent wonder at the horse and rider as it ascended. The

climax of the performance, the rapid descent, was at hand. This time it proved to be a real fall. How it happened, for it went so quickly, no one is able to tell positively. The horse may have become restless and thrown the board or platform into motion; in short, amidst the outcry of the spectators, both man and beast fell into the arena instantly killed. Fortunately no more lives were lost.

GREAT MUSIC COMPOSERS

Magnificent reations of Musical Genius—Compositions That Have Filled the World with Their Fame.

THE line which divides talent from genius has never been more clearly defined than in these words of an English writer: "Talent's age is a span; genius spans the ages." To make some stir in the world is granted, comparatively speaking, to the many, but to write enduringly in the book of mankind's history is the privilege of the few, for no mere ability in any line can bring more than transient fame.

In music particularly is this true. Every year, almost every month, sees the triumph of some composer of whom we say that he has genius, but who, nevertheless, soon sinks back into the oblivion from which he emerged; while over all this ebb and flow of names that can start little ripples of applause, the fame of the truly great musicians, the masters, the "men whose names like stars shall stand," endures, and but becomes greater with the flight of time.

Bach, Handel, Haydn, Mozart, Beethoven, Wagner—these are the names to conjure with, while lesser lights come and go, proving only how much they owe to those greater ones who have gone before.

It is a wonderful thing, this enduring quality in the work of the masters of music, as generation after generation arises to pay its share of tribute to and reap its share of benefit from the half hundred really inspired compositions which are destined never to die. An abiding interest in the lives and personalities of the workers goes naturally hand in hand with interest in the work.

The student of character and the lover of biography have much to be thankful for in the case of the German masters, for in nearly every case we know their lives, their aims, their difficulties, their triumphs. Sebastian Bach, for instance, although a hundred and fifty years have

elapsed since his death, is clearly before us even as a child—a little orphan with a magnificent heritage of musical ancestry, waiting until the household was asleep and then stealing from his bed to pore eagerly over a score with only the moon for light.

Later we see him at the organ, able, by the magic of his touch, to hold in thrall even the ignorant peasantry, who would listen from the church door and say among themselves, "It is Johann Bach—or the devil—who plays!"

As a composer, Bach was far in advance of his day. His wonderful "Passion Music," which is to be heard to-day in our churches, was unappreciated for a hundred years because there was no one to comprehend its depth, but it had only to be worthily interpreted to find lasting fame. Above all, he was of marvelous originality, and it is not too much to say that his influence upon the world of sacred music has been greater than that of any other composer. And in this connection it is well to note how characteristic of the man is his work. Its solemnity may be to a great extent the outcome of those boyhood musings, alone with the night and his own great heart, its depth and fervor the natural indices of Bache's intensely religious nature.

BEETHOVEN PLAYING ONE OF HIS GREAT COMPOSITIONS AT THE HOME OF MOZART.

The same peculiarity is noticeable in the music of Joseph Haydn, whose "Creation," written almost upon his death bed, gleams with such extraordinary brilliancy and fire. It is like a mirror in which we may see the reflection of a man to whom life was a good and glorious thing. The story of Haydn's "Farewell Symphony" is full of beauty.

Universally Admired.

As chapel master to Prince Esterhazy, at Eisenstadt, he received with chagrin the news of his patron's determination to disband his orchestra. The symphony was played before the prince, each player as he finished his part taking his light and his music and stealing away until the stage was left empty and in darkness. Prince Esterhazy never mentioned disbanding again, so powerful was the effect of Haydn's work. The fact that "The Creation" is based upon Milton's "Paradise Lost" endeared the composer to a multitude of English music lovers, and when he crossed the channel for a brief stay in London half England rose to do him homage.

Gluck has been called the father of opera, and in a sense this is true. Certain it is that out of artificiality he brought simplicity, and out of insipidity strength. The production in Paris of his "Iphigenie" produced the greatest sensation the musical world has ever known. The jealousy of a certain clique, inimical to Marie Antoinette and hence to her protege, could not impair Gluck's success, for so spontaneous was the applause of the unprejudiced that it swept away jealousy like chaff.

The predominant quality of Mozart's work is pure melody. Excelled though he was in particular lines by Beethoven, Handel and Haydn, his versatility made him the idol of Europe, and from early childhood his career was a continuous triumph. Perhaps his very precocity was responsible for the brevity of his life. He died at the age of thirty-six, and yet he contrived to make for himself a place in the world which no one has been able to fill. He was to music what Keats was to poetry and Raphael to painting, an apostle of the beautiful whom death alone debarred from unexampled fame.

The story of Mozart's last hours is peculiarly pathetic. For some time he had been working feverishly on his famous requiem mass. As his strength failed he summoned his friends to his room, and there, as they rendered for the first time the wonderful score, the composer's life went out. He had written his own requiem.

Sublime Genius.

Only the sublimity of Beethoven's genius saved him from an existence of sorrow and humiliation. His father submitted the boy to a rigorous musical training, driving him to the piano, threatening, urging, harassing. In later life he lost the woman he loved; and not only this, but he lost his hearing and his sight as well. His position in the household of Prince Lichnowski, in Vienna, and the honors paid him by his countrymen, could not compensate for his misfortunes. One has only to listen to his music to know that its composer was an unhappy man.

Following close upon these great leaders of the classicist came a school of composers wedded to romance—Weber,

Meyerbeer, Mendelssohn, Wagner and Liszt. It was but yesterday that the two last were living, and those who knew them are still alive.

A Born Musician.

Felix Mendelssohn-Bartholdy, grandson of Moses Mendelssohn, the famous philosopher, was, like Bach and Mozart, a musician almost from the cradle. His wonderful ear for harmony, which, at the age of seven detected an error in one of Bach's fugues, made him an incomparable orchestra leader. It has been said of him that he was "the musician of the unmusical, as Longfellow was the poet of those who saw only the prose of life for themselves."

As a matter of fact, it was this ability to charm all men rather than captivate a few that has set his name in its niche of fame's temple. Judged by comparison, Mendelssohn was scarcely a towering genius; yet of no musician is the memory more affectionately cherished by the world. He was the founder of the Leipzig conservatory.

Like Mendelssohn, Meyerbeer was a Jew whose boyhood held promise of the future. At nine the finest pianist in Berlin, he soon learned to despise all save creative work, and from this ambition sprang four of the best known operas of to-day—"Les Huguenots," "L'Africaine," "Robert le Diable," and "Le Prophete."

Richard Wagner was wont to declare that hearing one of Beethoven's symphonies made him a musician. It was a natural result of association that he should have been as much of a dramatist and theatrical director as a musician, for his sister, Rosalie Wagner, was a tragedienne, and his family were intimately associated with the stage. A thorough revolutionist, he nevertheless endeavored for a time to cater to popular prejudice. Happily, he was diverted by his failures, and by accidentally hearing the legend of the Flying Dutchman from some Norwegian sailors. That Wagner's music should only have come in vogue because the mad Ludwig of Bavaria patronized him is, perhaps, something of a reflection upon popular appreciation, but there is no question of his standing to-day.

Unrivalled Pianist.

Liszt, the friend and adviser of Wagner, and the father of Wagner's wife, was above everything a pianist, and since his death no one has been able to play his music as it should be played. The touch of the master hand is lacking, and, without that, for those who remember Liszt, there can be no satisfaction in renderings of his work.

In so limited a space it is impossible to do more than touch briefly upon the great composers of the classic, romantic and modern schools of Germany. No discussion of their work can be entered upon, and the merest outline of their personalities is admissible.

It is indeed a fortunate thing that so rich a store of information is available, for to hear an opera without knowing anything of the composer's personality, aims and ambitions, is to be content with a half pleasure when but little exertion would secure a whole. Thoroughly to appreciate the significance of the music one must have learned under what circumstances, and influenced by what condi-

tions, it was born in the composer's mind.

The thunders of "Tannhauser" and of "Lohengrin" acquire a new meaning when one learns that they are but echoes of the revolutionary tumult that was shaking Germany at the time these operas were written. Knowing the life of Beethoven, the adagio of his "Moonlight Sonata" deepens and strengthens and becomes not mere abstract pathos, but another form of his longing and infinitely affecting prayer: "Only love can give me a happier life. O God, let me find her—the one—at last!" And what but a knowledge of how it came to be can give the listener the clew to the significant undercurrent in Mozart's famous "Requiem?"

To this deeper understanding of a composer's work nothing but familiarity with his life suffices, and where we love music it is but natural to love the musician also. However great a genius a man may be, there is a certain satisfaction in the knowledge that after all he was but a man, "of like passions" with the humblest of admirers. These masters of music have passed away, but they have left to us something that can never pass. For us it is, therefore, to keep alive an interest in their lives and personalities which shall help us to a clearer conception of their works and splendid genius.

NEW NIAGARA BRIDGE

Marvellous Structure With an Immense Span—Size of Other Notable Bridges.

THE largest stone bridge on the face of the earth is that finished in May, 1885, at Lagang, China. Chinese engineers had sole control of its construction. It crosses an arm of the China Sea, is nearly six miles in length, is composed entirely of stone, and has 300 arches, each 70 feet high. It is the most colossal structure ever reared by man, yet we sneer at the "heathen Chinee."

The largest truss iron bridge in the world crosses the Firth of Tay, Scotland. It is 18,612 feet in length and composed of 85 spans.

The longest wooden bridge in the world is that crossing Lake Ponchartrain, near New Orleans, La. It is a trestle-work, 21 miles in length, built of cypress piles which have been saturated with creosote oil to preserve them.

The highest bridge in the United States is over Kinzina Creek, near Bradford, Pa. It was built in 1882, has a total span in sections of 2051 feet and is 301 feet above the creek bed.

One of the largest spanned bridges in the world has been constructed at Niagara Falls. Early in the fifties the first iron spanned bridges were built in France and Switzerland. At that time the length of

a spanned bridge was not more than about 275 feet. In 1860 a bridge was built at Koblenz, Germany, the length being 294 feet, and as more bridges were built they increased in length until at the present time the Niagara bridge leads

NEW NIAGARA BRIDGE. THE LARGEST SPAN IN THE WORLD.

with a span or length of over 768 feet. The entire length is over 1134 feet, but this includes the two minor bridges at either end built on the span.

The trolley running over the bridge is 190 feet above the river. Work was commenced in 1895. Plans were made by Engineer L. L. Buck, and the constructional work was done by the Pencoyd Iron Works of Philadelphia. Previous to the building of this bridge, the one at Bonn, over the Rhine, was considered the largest. From the bridge at Niagara one of the very best general views of the two falls, Goat Island, the parks and adjacent scenery is to be had. The floor of the bridge is 190 feet above the water, and the sensation in crossing is one of awe, which is speedily dispelled in admiration of the surrounding scenery.

Following is a table of the lengths and height of spanned bridges in the world, from which it will be seen that great bridges are mostly of modern origin.

	Length feet.	Height feet.
The New Niagara	768	135
The Bridge at Bonn.	561	90
The Bridge at Dusseldorf	543	81
The Bridge at Porto	515	132
The Bridge at Mungstener	510	321
Grand Trunk at Niagara	501	102
Bridge at Saint Flour	495	180
Bridge at Levenson, Kaiser	489	48
Bridge at Pia Maria, Portugal	480	108
Bridge at St. Louis	474	42
Bridge at Grunethal	468	63
Bridge at Paderno, Italy	450	111

FAMOUS POLAR EXPEDITION

Story of Dr. Nansen and His Thrilling Achievements Among the Icebergs of the Northern Sea.

OUT of the silence and the mystery of three long years—out of that great unknown area which lies frozen around the Pole — Frithiof Nansen, the gallant Norwegian, suddenly and unexpectedly, in a most surprising manner, emerged. He himself told us that we were not to be anxious even if it were five years before we heard from him, seeing that his project was to drift with the Polar current which he believed existed across the North Polar regions, then south along the east coast of Greenland. Anxiety and doubt, however, were not to be allayed, particularly in the hearts of his more immediate relatives and friends.

Still, back he came in all his old familiar vigor of frame and ardor of spirit, restored to the world of science, which looks for records unique and valuable from his experiences, and to the greater world of all those who can admire endurance and sacrifice for an ideal.

NANSEN AND PARTY HAULING SUPPLIES FROM THE SHIP.

It has been frequently stated that Nansen failed, in that he had not reached the North Pole. Others have pointed out that he has not failed, in that his object was not to reach the North Pole (that mathematical point in which the axis of our globe has its northern termination), but to explore the unknown Polar area. It is worth stating, however, that though Nansen came short of his own object his expedition nevertheless was a great geographical success.

MEETING OF DR. NANSEN AND MR. JACKSON IN FRANZ JOSEF LAND.

In his lucid address before the Royal Geographical Society, in which he laid down his alluring programme, Nansen made it abundantly clear to all who followed him closely that although he did not consider the actual reaching of

the Pole to be essential to the success of his expedition, yet the great object of his voyage was to compass the crossing of the North Polar region; to enter it from off the coast of Siberia, and to go out of it on the American side.

In that he did not do this—in that he reached his highest point while yet on this side of the North Pole, he, in a measure, came short of the object he placed before himself; but in having navigated a ship farther north than any ship has ever yet been impelled by man (for Sir George Nares, who previously held the record, reached 82 deg. 24 min. in the "Alert"), and in that he himself, by sledging across the Polar pack, traveled a distance of 170 geographical miles farther north than has ever been previously attained, Nansen may properly be considered to have achieved a great Arctic success, and brought the record to a point which it will require the highest pluck, the greatest labor, or the happiest fortune to surpass.

Moreover, since he drifted in his ship or marched on the ice from 133 deg. 37 min. E. long. to 55 deg. E. long., he passed over a great part of the Eastern Polar Sea, and is able to tell us of the distribution of land and water, climatic conditions, the ice movements and currents, and the general geographical character of that large area.

DR. NANSEN AND LIEUTENANT JOHANSEN LEAVING THE "FRAM."
"GOOD-BYE ONCE MORE."

This point has not been generally noted, but it is worthy of attention, that he might have gone north to his present limit and almost due south again without

being able to tell us much of the unknown Polar region; but seeing that he drifted in his vessel, the "Fram," in a northwesterly direction—a direction he followed to his highest point (86 deg. 14 min. N. lat.)—and then came south in a southeasterly direction, he covered almost the widest area of the earth's surface that he possibly could. Thus his expedition was a great geographical triumph.

Its story reads as one full of adventure and peril, and of the swift changes in fortune which are so familar to us in the records of former expeditions. But few experiences of Arctic exploration have surpassed in thrilling interest the adventures of Dr. Nansen and his single comrade.

One of the first points of interest in this wonderful story is the fact that the "Fram" fully justified Nansen's sagacity in having her built on so rounded a model that she should afford the least possible resistance to the oncoming ice, for when the overwhelming ice-floes closed about her, as though to crush her down, the vessel slowly broke away from the pack at the water-line, and, the ice passing underneath her, quietly rose out of the great crystal cradle in which she had been so firmly frozen.

CAUGHT AND WRECKED IN ARCTIC ICE.

Another instance of the explorer's foresight is furnished in his idea of generating electric light during the long Polar night. Many people thought that this was a mere theoretical whim, likely

enough to commend itself to the pure man of science, but unlikely to be put into action when the strenuous toil of actual exploration had begun. Yet this was not the case; the electric light generated by his windmill fulfilled his expectations, and it is easy to conjure up a vision of the gallant Norwegians, when the wind failed and the sails of the windmill flapped uselessly, going forward to the capstan on the deck, and beginning to tramp round and take that regular exercise to which Nansen looked as a means for the preservation of their health.

Farthest North.

Another picture. It is March 14th. The "Fram" has slowly drifted until she has reached a point farther north than any ship has previously reached, but the direction of her drift is westerly, always westerly, and there is little or no prospect of her coming near the North Pole.

Nansen steps over the side of the "Fram" with his companion Johansen, each with his little skin canoe for use in open water, and accompanied by twenty-eight dogs to pull their three sledges. The dogs had food for thirty days, the men for one hundred. When the dogs' food failed a dog was to be killed to satisfy his fellows; when the men's food came to an end some Arctic gulls or a bear or a walrus or a seal, if they were fortunately at hand, were to be the sole source of supply. The hardships of the explorers and their safe escape are matters of history.

From a published account of the expedition that rescued Dr. Nansen, we take the following details:

"The return of the 'Windward' steam yacht, which arrived in the Thames from Tromso, in Norway, bringing home several members of the party led by Mr. F. C. Jackson in the Arctic exploring expedition designated by his name jointly with that of Mr. Harmsworth, its munificent patron, is a gratifying event which is in time to lay before the British Association of Science, at Liverpool, the results of Mr. Jackson's observations, with those of other members of the staff, concerning the geography, the botany and zoology, and all the natural features of that remote land, so long unknown and hitherto so difficult of access, where they have spent many months, summer and winter, since their vessel left.

Their Log Huts.

"The 'Windward' returned to Vardo and sailed again for Franz Josef Land, where Mr. Jackson had established on Cape Flora a little hamlet of log huts called Elmwood. But, in addition to the direct object of this mission, which had been so largely realized, the 'Windward' has also had the good fortune to meet on the desolate shore of Franz Josef Land and to convey home to his own country the eminent Norwegian explorer, Dr. Nansen, whose heroic efforts during the absence of three whole years from the civilized world at a brave sacrifice of ease and comfort have obtained for us some knowledge of the actual condition of the Polar region to within 226 miles of its center north of the Asiatic continent, while he has shown the way to reach the Pole itself by traveling so far northward over the ice.

"We obtain, indeed, a considerable amount of information concerning Franz

Josef Land, which was discovered many years ago by the Austrian, Julius Payer; the proof of its insular position, the channel leading from it into 'Queen Victoria Sea,' with the bays, inlets, capes, and promontories which Mr. Jackson has first seen and named; the plant and animal life of that country, and other knowledge gathered during his sojourn at 'Elmwood, Cape Flora'—or in his boat excursions to the neighboring waters.

The Polar Ocean.

"Speaking generally of these recent achievements of Arctic exploration, they may be said to have ascertained the fact of the existence of the Polar Ocean which, in all probability, entirely surrounds the most northerly extremity of the globe. The phantom of an indefinite extension of land beyond the shores of Franz Josef Land, which had already been visited, and which are now, by Mr. Jackson's persevering labors, proved to be those merely of an island, with a distinct geographical outline, has been cleared away; and a long line to be drawn from those shores in a northeasterly direction over a frozen or rather ice-covered space of sea, traversed by Nansen with his sledges, will appear extending to the point where he was compelled to desist from his direct march toward the Pole.

"We feel cordially satisfied, as a matter of national ambition in such deeds of grand and gallant enterprise, with the share which has fallen to the lot of our own countrymen in this undesigned combination of the most recent geographical discoveries.

"Mr. Jackson had explored the coasts of the most northerly land yet known to exist nearly four months before Dr. Nansen came down from the higher latitude which he had attained by marching over the ice some hundred miles away to the east. He had given, as he had a good right to do, the names of the British, Channel,' and the 'Queen Victoria Sea,' to the waters he found opening northward, beyond the 'Austria Sound' of Payer, adding to these designations, at successively observed recesses or interruptions of the water-space, in what is likely to be an archipelago with many smaller islands, the English honored and home-remembering names of 'Clements Markham Bay,' 'Allen Young Sound,' 'Robert Peel Sound,' and of 'Cape Albert Markam,' 'McClintock,' 'Sybil Montefiore,' and those of islands 'Mary Elizabeth,' after his own mother; 'Scott Keltie,' but lastly, that of 'Frithiof Nansen,' happily associated with this nomenclature of the Franz Josef Land archipelago by the Norwegian explorer's descent upon its shores.

Future Explorations.

"Henceforth, being so far made acquainted with what is undeniably proved to be 'the most important body of water in this part of the Arctic regions,' to the north of the Old Continent, we may anticipate a corresponding extension of the general scope of Arctic exploring work on the other sides, or from other points of the circumference of the Polar Circle."

A very remarkable thing about Polar exploration is the enthusiasm with which it is taken up and the willingness to undergo all sorts of hardships in the effort to find that elusive North Pole.

YACHT WITHOUT A RIVAL

Magnificent Vessel Built in the United States for the German Emperor.

THE Emperor of Germany's new schooner yacht, built at Shooter's Island, New York, is the largest vessel of her type afloat, and the most sumptuously fitted out. In fact, she is absolutely peerless on the high seas with respect to magnificence of appointment. Besides, she is a very fast boat.

When the commission was placed with an American firm of boat builders to construct a yacht for his Royal Highness Wilhelm II, it was with the understanding that seaworthiness and racing qualities be made the foremost considerations. After these qualifications had been complied with there was, of course, to be as much elaboration of the plans as possible; but the first requisite was to secure a swift yacht, after that to attend to the details of ornamentation.

As a specimen of marine architecture the yacht is a marvel. She is constructed almost entirely of steel, and circling her hull is an air compartment which practically amounts to giving the boat a double body. She is also provided with double water bottom compartments.

Her dimensions are:—

Length on water line	120	feet
Length over all	160	"
Draught	15	"
Extreme beam	27	"
Length of foremast	100	"
Length of mainmast	107	"
Length of main boom	86	"
Spread of canvas about	12,000	square "

This area of canvas, taken with the fine lines on which she is built, make the Kaiser's yacht a flyer.

In finish the new boat called into requisition the most skilled labor available in this country and the most costly materials obtainable. The decks are made of teakwood, laid on in narrow strips and polished down to a surface as smooth as velvet. The hull is painted a glossy white, while all the metal fittings, such as the capstan, winches, etc., are of burnished bronze.

Skylights giving soft effects in illumination supply light to all the principal cabins and saloons, which are finished in superb style with carvings in various kinds of hard woods. The main saloon, located amidships, is twenty feet in length, and extends the entire width of the ship. It contains a long table, capable of seating twenty-four persons comfortably at one time. Around its walls are cushioned divans; there is a large open fireplace at one end, surmounted by an ornate mantel; a piano and music rack occupy another portion of the room; and a writing table and some ornamental chairs complete the furnishings.

The Emperor's private stateroom is aft of the main saloon, communicating directly with the latter. It occupies half of the yacht's width, the other half being taken up by three smaller staterooms intended either for the use of members of the royal family or for the guests of

the imperial yacht enthusiast. The Kaiser's stateroom is furnished with a brass bedstead, dressing table; escritoire and an easy chair or two. Adjoining it is a bathroom lined throughout with marble tiles and supplied with both hot and cold water. Aft of the Emperor's apartment comes the vestibuled stairway leading to the deck house above. This is a steel structure for use in bad weather. There is a chart room aft of the companion way, and at the stern of the yacht is a small saloon for the ladies.

Immediately forward of the main saloon are the galleys—first the Emperor's, and then, separated from it by a bulkhead, the galley for the yacht's officers and crew. The galleys are equipped with the most modern cooking utensils, and, under the management of the Emperor's own favorite chefs, are capable of offering a sumptuous banquet. There is a small refrigerating apparatus, pantries, cupboards, wine closets and linen lockers, all reproduced on a small scale with a completeness that would defy the cuisine of the finest hotel.

Alongside of the galleys are located the staterooms for the captain, first officer, sailing master, the two stewards and the two cooks. Forward of the galleys is the forecastle, where the crew is located. In this compartment ample accommodation is provided for a crew of twenty men, who are quartered in much more luxurious style than on the average warship.

GROUP OF CURIOUS THINGS

IN the suburbs of Tacoma is a little wooden edifice called St. Peter's Chapel, which owns not only the oldest but probably the quaintest bell tower in America. The church was built in the early seventies in old Tacoma, which was then, a small lumber camp. Bishop Morris built the church in an incredibly short time almost over night, and this unique bell tower was his idea.

He left a magnificent fir tree, three hundred or more years old, standing beside the little chapel. The topmost branches were cut off, leaving the trunk, forty feet high, smooth and shapely. On top of this a bell tower was built, surmounted by a cross.

A short ladder reaches from roof to tower. The bell ringer need not ascend the tower to sound the call to worship; a rope is attached, by means of which the bell may be rung from the ground.

For many years the trunk of this tree was a mass of living ivy, which never

lost its color throughout the year. English ivy, which thrives in that moist climate, was planted about the church, and trained to grow through the windows and spaces left for it, until the whole interior was more or less decorated with it. The space behind the altar was a great sheet of vivid green. For the past few years the ivy seems to have been neglected somewhat, but the church is still a Mecca toward which many travelers turn their footsteps when in search of quaint and curious sights.

Indian Earrings.

Paraguay has people who wear the strangest ear ornaments in the world. They are members of the Pilaga tribe, which is an offshoot of the Toba. First they bore their ears and then in the holes they place pegs, made of very costly wood, which is known as "bobo."

The pegs are cylindrical, beautifully carved, and as a rule are about seven centimetres in diameter, and from two to three centimetres in thickness. Sometimes, moreover, they are either richly painted or covered with plates of silver or lead or with some round bits of sea shells or with fragments of looking glass, which are fastened to the peg by means of black wax.

These grotesque ornaments are naturally rather heavy, and as a result the ears, after some years, attain to an extraordinary length, frequently coming down as far as the shoulders.

New Food Product.

High up on the slopes of the Andes Mountains, in Bolivia, Ecuador and Peru, grows a plant called "quinoa," which is nearly related to the common pigweed of our gardens. It is cultivated in that part of the world, finding most suitable conditions for its development from two miles to two and a half miles above the level of the sea.

The plant attains a height of about two feet, and is grown for the sake of its seeds, which are used as we utilize wheat—for making bread and porridge. About the size of small bird shot, they contain as much nutriment as wheat does, in proportion to bulk, and the natives depend upon this crop mainly for their food supply. To them, indeed, the "quinoa," is an all-important food plant.

Recently our government has been seeking in every out-of-the-way corner of the world for little known plants of value, with a view to introducing them to cultivation in the United States, and, out of quite a number such already found, the "quinoa" seems to be one of the most desirable. It is, in effect, a new cereal, and hopes are entertained that it may be grown to advantage over the northern part of the Great Plains region.

The northern plains of the Middle West have a climate not very unlike that of the high levels in the Andes to which the "quinoa" is a native. There is a similar dryness, with long and severe winters and correspondingly short summers. But it has also been suggested that the plant might be grown satisfactorily over large areas in the interior of Alaska, where a suitable cereal, capable of resisting cold and producing a reliable crop, would be a godsend.

Chinese Taught Secretly.

In China little attention is paid to the education of girls, and moreover

very little information is given by natives to foreigners, who show much interest in this subject.

Chinese girls who have come under the influence of missionaries are taught to read, write, and they also devote some time to the study of geography. Except for their dress, these little girls look much like American girls.

Exclusive Greenland.

Greenland, with its icy mountains, is not only cool but very exclusive, for it does not invite visitors, and it even makes it inconvenient for tourists to land on the little bit of occasionally green land that surrounds its great heart of perpetual ice. Permission must be had from old, conservative mother Denmark before aliens can visit the not very inviting northern colony.

Denmark is indeed very careful and conservative in the management of Greenland affairs. The trade there is monopolized by the State, and only government vessels are welcomed to Greenland waters. This, says Denmark, is to protect the Greenlander from unscrupulous merchants. And to make sure of the people's welfare, the State fixes both the price they shall pay for food and the price they shall sell at.

The quantity sold is also regulated, so that the natives will not leave themselves short of food or clothing. In fact, the Greenlander is under quite strict guardianship, and is allowed to buy no spirituous liquors.

The trade between Greenland and the mother country is, as a rule, carried on by nine vessels belonging to the Greenland Company, under government direction.

Yucatan Chewing Gum.

In Yucatan the tree known as the Ya grows plentifully all over that region. When the bark is cut a milk-white sap exudes, which is reduced by boiling to large lumps. In this shape it is imported in great quantities into the United States.

The average tree yields about six pounds of the gum, and the total production each year is in the neighborhood of 1,000,000 pounds, nearly all of it going to the United States. The tree grows to a height of seventy feet or more, and its fruit much resembles a russet apple in appearance.

The crude gum is absolutely tasteless—a very desirable quality from the viewpoint of the manufacturer of chewing gum, inasmuch as he is able to put into it what flavors he likes.

But the finest gum, which costs a dollar a pound in Yucatan, does not find its way out of that country at all. It is obtained from the unripe fruits of the Ya tree.

Ancient Glass Painting.

Glass painting has fallen almost to the level of China painting; but it might be greatly superior now to what it was in ancient times. There is an ignorant opinion among people that the ancient art of glass painting is completely lost; it is totally void of foundation, for we can carry it to a much higher pitch than the ancients, except in one particular color, and we come very near to that. We can blend the colors, and produce the effects of light and shadow, which they could not do. And we have far better mechanical appliances for doing the work than were known to glass painters of old.

Thrilling Story of Vesuvius

Destruction of Pompeii and Death of Pliny the Elder Related by His Nephew.

MORE than once, in reading the news stories from the scene of the great catastrophes on Martinique and St. Vincent, students of the classics must have been reminded of those famous two letters of the younger Pliny to the historian, Tacitus, in which he gives the details of that eruption of Vesuvius in August of the year 79 A. D., which destroyed and burned Pompeii, and in which the letter writer's uncle lost his life in exactly the same manner—by suffocation—in which so many found death in the West Indian Islands in 1902. Indeed, with but the change of names the description of those letters of the first century might be applied to this disaster of the twentieth.

Following are the principal parts of the two letters, which are numbered 16 and 20 in the sixth book of Pliny's collected epistles. The translation used is that of the Earl of Orrery:

"You are desirous that I should give you an account of the death of my uncle, that you may be enabled to transmit it to posterity with the greater truth. I return you thanks. I foresee that his death, when celebrated by you, must procure eternal honor to his name; for, although his fall was attended by the destruction of most beautiful territories, seeming as it were, destined to be remembered equally with those nations and cities who perish by some memorable event; although he had compiled works both numerous and lasting, yet the immortality of your writings will lengthen out the character which he has established to himself.

"He was at Misenum, where he had the command of a fleet which was stationed there. On the ninth of the calends of September (August 23) about the seventh hour (1 o'clock) my mother informed him that a cloud appeared of unusual size and shape. After having reposed himself in the sun and used the cold bath, he had tasted a slight repast and was returned to his studies; he immediately called for his sandals and repaired to a higher point of view, from whence he might more plainly discern this prodigy. The cloud (the spectators could not distinguish at a distance from what mountain it arose, but it was afterward found to be Vesuvius) advanced in height, nor can I give you a more just representation of it than the form of a pine tree, for springing up in a direct line like a tall trunk, the branches were widely distended.

"I believe while the vapor was fresh it more easily ascended, but when that vapor was wafted the cloud became loose, or, perhaps, oppressed by its own gravity, dilated itself into a greater breadth. It sometimes appeared bright and sometimes black and spotted, according to the quantities of earth and ashes mixed with it. This was a surprising circumstance, and it deserved to be inquired into. He commanded a Liburnian galley to be prepared for him, and made me an offer of accompanying him if I pleased.

"I replied it was more agreeable to me to pursue my studies, and, as it happened, he had allotted me something at that time to write. He went out of the house with his tablets in his hand. The mariners at Retinae, being under consternation at the approaching danger (for that village was situated under the mountain, nor were there any means of escaping but by sea), entreated him not to venture upon so hazardous an enterprise. He continued firm to his resolution, and performed, with great fortitude of mind, what he had at first undertaken from thirst of knowledge.

TERRIFIC ERUPTION OF THE GREAT CRATER OF VESUVIUS.

"He commanded the galleys to put off from land, and embarked with a design not only to relieve the people of Retinae, but many others in distress, as the shore was interspersed with a variety of pleasant villages He sailed immediately to places which were abandoned by other people, and boldly held his course in the face of the danger, so composed as to remark distinctly the appearance and progress of this dreadful calamity, and to digest and dictate those remarks.

"He now found that the ashes beat into the ships much hotter and in greater quantities; and, as he drew nearer, pumice stones, with black flints, burnt and torn up by the flames, broke in upon them; and now the hasty ebb of the sea and the ruins tumbling from the mountain hindered their approach to the shore. Pausing a little upon this, whether he should not return back, and instigated to by the pilot, he cries out: 'Fortune assists the brave; let us make the best of our way to Pomponianus,' who was then at Stabiae,

and lay opposite to a bay, into which the sea, creeping gently along that winding coast, insinuates itself.

Shooting Flames.

'Pomponianus, although not in immediate peril, yet seeing it plainly, and finding it approaching fast, was putting his baggage on board some vessels, with a design of making his escape by sea, whenever the contrary wind should abate. My uncle arriving with a fair wind at this place, embraced, comforted and encouraged his trembling friend; and, to effect this, seemed himself to be under no kind of apprehension; but, ordering his servants to carry him to the bath, when he had bathed went to supper, either with a real cheerfulness or, what is equally the sign of a great mind, the appearance of it.

"In the meantime flames issued from various parts of Mount Vesuvius, and, spreading wide and towering to a great height, made a vast blaze, the glare and horror of which were still increased by the gloominess of the night.

"My uncle, to move the general fear, said that the blaze was occasioned by the village being on fire, which was now deserted by the country people. Then, retiring to take his rest, he enjoyed a sound sleep; for, being of a gross and corpulent habit of body, he was heard to snore by those who waited upon him. The court, beyond which was his apartments, by this time was so filled with cinders and pumice stones, that had he continued any longer in his room, his passage from it would have been stopped up.

"Being awakened, therefore, he quitted his chamber, and returned to Pomponianus and the rest, whose fears had hindered them from sleeping, and who had been upon the watch. They consulted together, whether it would be more advisable to keep under the shelter of that roof or retire into the fields; for the house tottered to and fro, as if it had been shaken from the foundation by the frequent earthquakes.

"On the other hand, they dreaded the stones, which, by being burnt into cinders, although they fell with no great weight, yet fell in large quantities. But, after considering the different hazards which they run, the advice of going out prevailed; in others, one kind of fear conquered another; in my uncle, one prudential reason only succeeded to another.

Efforts to Escape.

"They covered their heads with pillows bound with napkins; this was their only defense against the shower of stones. And now, when it was day everywhere else, they were surrounded with darkness blacker and more dismal than night, which, however, was sometimes dispersed by several flashes and eruptions from the mountain. They agreed to go farther in upon the shore and to look out from the neighboring land if they might venture to sea; but the sea continued raging and tempestuous.

'Then my uncle, laying himself down upon a cloth spread on the ground, called twice for some water and drank it; but the flames and a stench of sulphur which preceded them, obliged others to immediate flight, and roused him. He raised himself upon his feet, supported by two

servants, but his respiration being stopped, he immediately dropped down, stifled, as I imagine, by the sulphur and grossness of the air. His lungs, as he was narrow chested, were naturally weak and subject to inflammations. When the light returned, which was not until the third day after his death, his body was discovered untouched by the fire, without any visible hurt, in the dress in which he fell, appearing like a person sleeping than one was dead."

Added Terrors.

The narrative is continued in a second letter as follows:

"You tell me that my former letter, which at your own desire, I wrote to you concerning my uncle's death, has tempted you to inquire not only into the terrors, but the distress I suffered while I was left at Misenum; for with that particular my letter concluded.

"When my uncle was gone from us, I employed my time (having stayed behind for that purpose) at my studies. I bathed, went to supper, and had a very imperfect and restless sleep. We had for several preceding days together felt an earthquake, which, being common in Campania, did not much alarm us; but the shocks were so violent this particular night that all things around us were not only moved, but seemed on the brink of destruction. My mother hastened to my bed chamber at the moment of time when I was rising with an intention to awaken her, if I had found her sleeping.

"We retired into a little court, which lay between the house and the sea. I am in doubt whether my conduct ought to be called fortitude or thoughtfulness upon this occasion, for I was then but 18 years of age. I called for a Livy, and read it as if I had been quite at ease; and, in the manner I had begun, went so far as to select passages from that author. A friend of my uncle's who was lately come from Spain, on purpose to see him, finding my mother and me sitting thus together, and taking notice that I was reading, reproved the patience of her temper and the indifference of mine.

"However, I still continued intent upon my book. It was now 6 o'clock in the morning, yet there was but a faint and glimmering light. The house shook violently, and, though we were in an open court, yet, as it was very narrow, and built almost all round, we were certainly in great danger. We then thought it expedient to leave the town; the people distracted with fears followed us, and (such is the nature of fear, which embraces, as most prudential, any other dictate in preference to its own), they pressed upon us and drove us forward.

Sea Driven Back.

"When we were out of reach of the buildings we stopped; our astonishment was great, nor was our apprehension less, for the carriages which we had ordered out of town were so violently shaken from side to side, though upon plain ground, that they could not be kept in their places, even when propped by heavy stones. The sea, too, seemed to be forced back upon itself; repelled, as it were, by the strong concussions of the earth. It is certain that the shore was greatly widened, and many sea animals were left upon the strand.

"On the land side a dark and horrible

cloud, charged with combustible matter, suddenly broke and shot forth a long trail of fire, in the nature of lightning, but in large flashes. Then my uncle's friend, the same who came out of Spain, said to us with great vehemence and eagerness: 'If your brother and your uncle be still living, his wishes are implored for your safety. If he lost his life, he was desirous yours might be saved. Why, then, will you not immediately leave this place?' We answered that we were not so solicitous for our own as for my uncle's preservation.

Hurrying From Danger.

"He then hastily withdrew, running with the utmost expedition from danger. Not long after the cloud descending covered the whole bay and we could no longer see the Island of Caprea or the promontory of Misenum. My mother now began to beseech, advise and command me to make my escape in any manner I could. She observed that as I was young I might easily take my flight, but that she who was in years and less active, could patiently resign herself to death in case she was not the occasion of my destruction. My answer was: 'I will never attempt at safety if we are not together.' And then, leading her by the hand, I assisted her to go faster. She yielded with regret, still angry with herself for delaying me.

"The ashes now fell upon us; however, in no great quantities. I looked back. A thick, dark vapor just behind us rolled along the ground like a torrent and followed us. I then said: 'Let us turn out of this road, whilst we can see our way, lest the people who crowd after us trample us to death.' We had scarce considered what was to be done when we were surrounded with darkness, not like the darkness of a cloudy night or when the moon disappears, but such as is in a closed room, when all the light is excluded. You might then have heard the shrieks of women, and moans of infants and the outcries of men. Some were calling for their parents, some for their children, some for their wives.

Known by Their Voices.

"Their voices only made them known to each other. Some bewailed their own fate, others the fate of their relations. There were some who, even, from a fear of death, prayed to die. Many paid their adoration to the gods, but the greatest number were of opinion that the gods no longer existed, and that this night was the final and eternal period of the world. There were others who magnified the real dangers by imaginary and false terrors. Some affirmed that Misenum was burnt to the ground. The report, although not true, gained credit.

"A little gleam of light now appeared. It was not daylight, but a forewarning of the approach of some fiery vapor, which, however, discharged itself at a distance from us. Darkness immediately succeeded. Then ashes poured down upon us in large quantities, and heavy, which obliged us frequently to rise and brush them off. Otherwise we had been smothered or pressed to death by their weight.

"I might boast that not one sigh or timorous word broke from me through all this distress, had I not fortified myself with one great consolation, a miserable one, indeed, that all nature was perishing with me.

"At last this darkness, which now was

drawn into the thinness of a cloud or of smoke, went off. True day appeared. The sun shown forth, but pale, as at the time of an eclipse. All objects that offered themselves to our sight (which was yet so weak that we could scarce bear the return of light) where changed and covered with ashes as thick as snow. At our return to Misenum, after having refreshed ourselves, we remained in that suspense and doubt of mind which hope and fear inspire. For the earthquake still continued, and several enthusiasts, by dreadful prophecies, increased their own fears and the fears of others. But, although we had undergone many dangers and dreaded still more, yet we could not be persuaded to quit the town till we had received some intelligence concerning my uncle and the fate that befell him.

"You will read this account without any intention of making it a part of your history, of which it is by no means worthy, and you must blame yourself for requiring it from me, if you think it not worthy of a letter. Farewell."

DESTRUCTION OF ST. PIERRE BY AN ERUPTION OF MONT PELEE

Frightful Devastation on the Islands of Martinique and St. Vincent. Awful Catastrophe by Which 40,000 Persons Perished.

MR. J. MARTIN MILLER, who visited the islands of Martinique and St. Vincent immediately after the terrible eruptions that devastated them, thus describes the heartrending scenes:

Desolation absolute, ruin and dusky death—that is St. Pierre. In the world's history, since mankind was a part of it, there has never been so instant an extinction of human life as in this town of Martinique. Tidal waves, so called, great fires, plagues and other visitations have slain thousands, but not by means so sudden. In a moment, by the explosion of a volume of sulphur gas that had poured down the sides of Mont Pelee, a population was destroyed, a town flung into ruin, vegetation scorched from the face of the earth and panic shook the souls of thousands.

A thunderous darkness was falling down the slopes of Pelee. From new vents close at hand, two of them in the town itself, were gushing steam and dust, rolling and bursting to a height of a hundred feet. Other clouds were rising from ravines that have been cut into the sides of the mountains, and the inclined planes that reached from the sea verge to the peak smoked as with the firing of armies.

Indeed, the spectacle, except for the gloom that fell lower and lower out of the heavens, suggested nothing so much as lines of troops, miles in length and in many columns, fighting their way into the sky.

A yellow haze began to blow over the city, bringing a sharp and irritating smell of sulphur. It was time to be off. We did not stay on the order of our going. It is alleged of one of the geologists that he cleared twenty feet on the first bound. Leaping down the terraces, blundering over foundation stones strewn in piles over the streets, passing corpses, shriveled and half buried in ash drifts, we made with all possible speed for the shore, where two boats were waiting us.

Arms Full of Loot.

The last men came creeping laboriously down from the ruins with their arms laden with loot—not the kind that counts as such, but old dishes, door knobs, mantel ornaments, kitchen utensils and the like. Give a little credit to the men of the press. They found a safe with silver in it and a silver coffee pot and left it. An army man found a brass crucifix in the cathedral ruins and left it. In the tombs of the cemetery were lamps, wire frames for immortelles, statuettes and so on, and not one was abstracted. The things borne away as souvenirs are mostly of that rubrish which in a year or two will find its way into the ash barrel.

The appearance of St. Pierre is that of an adobe village in Arizona. The town is all unroofed, it has lost its upper stories, and it is the color of clay. It has been half buried in the ashy outpour of this last eruption, and albeit they positively assert that there has been no earthquake, but only a volcanic cyclone; I am sure there has been a shock. The once town was not under watch at every moment, and the damage which has recently been wrought could have occurred in a minute.

That a cyclone tore across the flank of Pelee is sure, but that does not account for the twisting of iron grills and fences and the wrenching asunder of great masses of stone. Could anything have done these things except an upheaval of the earth? After the first eruption, which destroyed the life, the houses were little injured. Though roofless and charred, the contents of many shops and houses were almost intact, whereas yesterday it was shaken to its foundations. Shops are not distinguishable from dwellings, and many streets are guesswork.

Shaken Into Confusion.

By a mighty thrust of force the volcano has shaken the masonry into wild confusion. There are heaps in the streets as high as the barricades of Paris revolutions. Interiors of homes, offices and churches are as deeply filled as the yards, and often it is a shred of wall paper or decorated plaster that is the only determining point in deciding which is the inside and which the outside of a building.

The cathedral towers, that had remained standing after the first eruption, were hurled down, and the fine bells that chimed so placidly, lie buried among the rubbish, the largest bell remaining unbroken, it would seem, though it weighs probably a ton and a half.

The fine altar of carved marble, with its brazen lamps and candles, is a wreck, and of any other ornamented portions of

the building not a shred is visible. The inside is deep in dust, and a sailor, in wading through it, stumbled upon a gnarled, brown, uncertain looking object, seamed with white.

"Hey, here's another o' them poor stiffs," he called to a comrade.

And a body it was surely, one of those who had sought refuge in the place to pray away adversity.

Bodies of the priests were also found here, one of them, it is said, in the attitude of prayer, but the uplifted hands in other cases, may have been mere proofs of the fall of burning dust. It is also said that the bodies of a throng were found in the square before the church, and that they were early collected and burned, but this again is not substantiated.

That on the morning of a feast crowds would come and go is presupposed and there was also to be a procession, with music and banners, and the company may have been gathering for that, but in time of trouble and anxiety the call of the church to her children is not unheeded, and these victims, leaving early mass or going to the later service, were better prepared for death than they could have been at any other time.

The other churches had their complement of worshippers also, but social and official life had not awakened. How hard it is to realize that there was life at all! One pictures the city gay in the sunshine, with its crowds dressed in colors fairly dazzling to visitors from lands of frost, with oleander and flamboyant hibis-

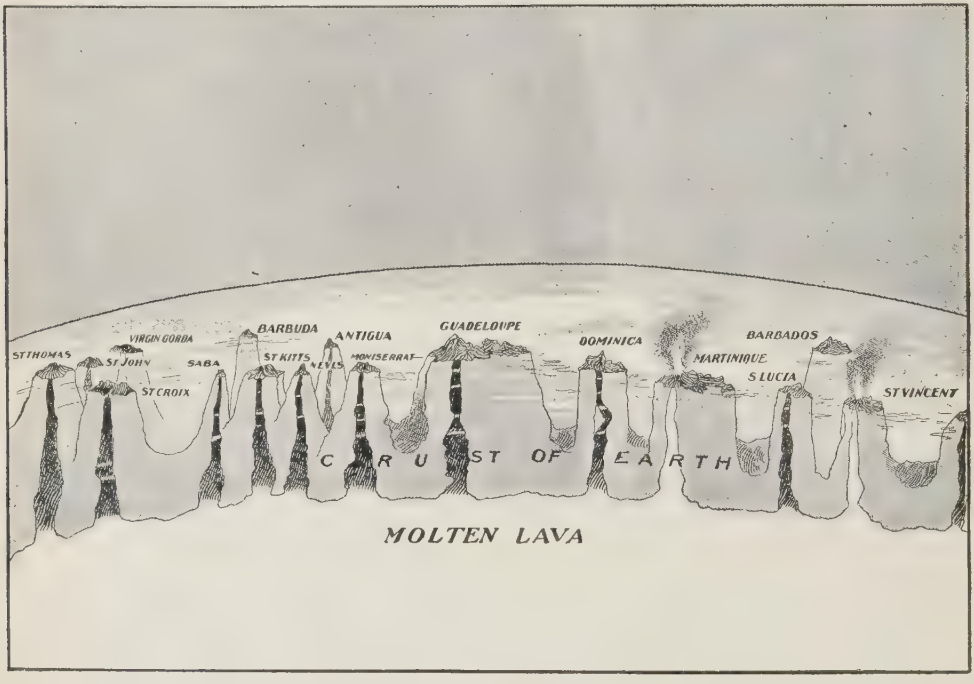


DIAGRAM OF THE VOLCANIC ISLANDS IN THE WEST INDIES.

When the molten lava comes in contact with water, the resulting steam causes earthquakes and upheavals, or volcanic eruptions.

cus and amaryllis blazing in the gardens, as a thing that never existed in the same land or century with this mournful, hideous wreck.

All Woodwork Destroyed.

Here was a club, here a hotel, there stood the Hotel de Ville, over yonder was the theatre, not a very substantial place, 'tis true, but seating 1500; back of it was the jail; out there by the cemetery was the bishop's palace, here was a hospital, here a market, a bank, a factory. All are blent in one wide downfall.

A curious phase of it all is the absence of floors, doors, roofs, window frames and furniture. Everything of wood was destroyed, save part of the little kitchens and outbuildings in the yards. It is the stoniest of ruins.

Sharp as was the flame that burst from the sulphur cloud, its duration was of the briefest. The destruction of St. Pierre was no doubt accomplished in less than thirty seconds. A tumbling green vapor, five miles of flame, and all was over. The cyclone with which the sea wind hurled itself upon the place, and the rain of dust that followed, did a kindly act of burial.

In that gust of flame, that explosion of gases which may have been ignited by fires in kitchens, everything of life disappeared. Trees were uprooted and killed. What was a pretty garden in front of the city hall is a waste of ash with a stagnant fountain in the centre, the only green thing in the view being its water.

But stop! What are these points pricking through the gray? Grass, as surely as the sun shines! Tropic vitality is deep and strong. The fire that blasted the sea foot of this mountain did not reach far into the soil and nature is asserting the power of life over death. And another token of life: here are ants at work. Tiny creatures, of small account in the world's economy, overlooked by men, have survived men, and are digging themselves out of this new Pompeii, as busy, as placidly uninterested in human affairs as on the morning of the calamity.

Their Splendors Blasted.

But the trees and flowers, the splendors of the torrid islands, are no more. Stately palms, at least fifty feet from base to crown, lie at length like slain giants, their roots already mantling with a fungus of brilliant orange. Hardly a stalk remains of the dracenas, cacti, bananas and other showy denizens of the public and private parks. The foilage that mantled the cliffy steeps behind the town is brown, a line of scorch extending from the sea along the hills, as clear as the line of char in a forest fire.

This city of St. Pierre was a miniature hanging garden. It fronted the sea with a pretty esplanade, of which nothing is left except old howitzers used as posts, and from that point it climbed the hill in terraces which were stopped by dangerous cliffs that are the edge of an old mud flow from Pelee. A pleasure ground at one corner of the town, and a statue of the Virgin on a promontory at another, were features that drew attention from tourists as they passed the capes and saw this charming panorama unfold itself, the houses of many colors, shining in a sun of southern brilliancy, flecked by tree shadows and flecked by gorgeous reds and yellow of flowers.

On landing it is found that even a part of the pavement on the beach is gone, or it may be buried under rubbish. The anchor chains and other ship stores along the water front are rusty and add to the look of long desertion. Nobody would imagine that this sea front had a row of shade trees and a mule railroad and benches for travelers and idlers to rest on.

Statue of Christ.

Not a hint of them is to be seen. The statue of Christ on the gable of the cathedral lies broken among the stone heaps. Where the band played on pleasant evenings not so much as a cricket chirps. The lighthouse that beckoned ships into the roadstead has disappeared.

What happened on that morning? An hour after sunrise Pelee, which had been uneasy for some days, began to send up columns of dust and steam, and mutterings were heard in the earth. What matter. Pelee had tried to frighten Martinique before. It would shake and smoke for a little; and then quiet down again, after its manner.

Poor people! There was almost time to escape, if you had known. The road to Fort-de-France was open. By running you could have won at least a chance of life. But no. This was the feast of Ascension, and heaven would be good to you.

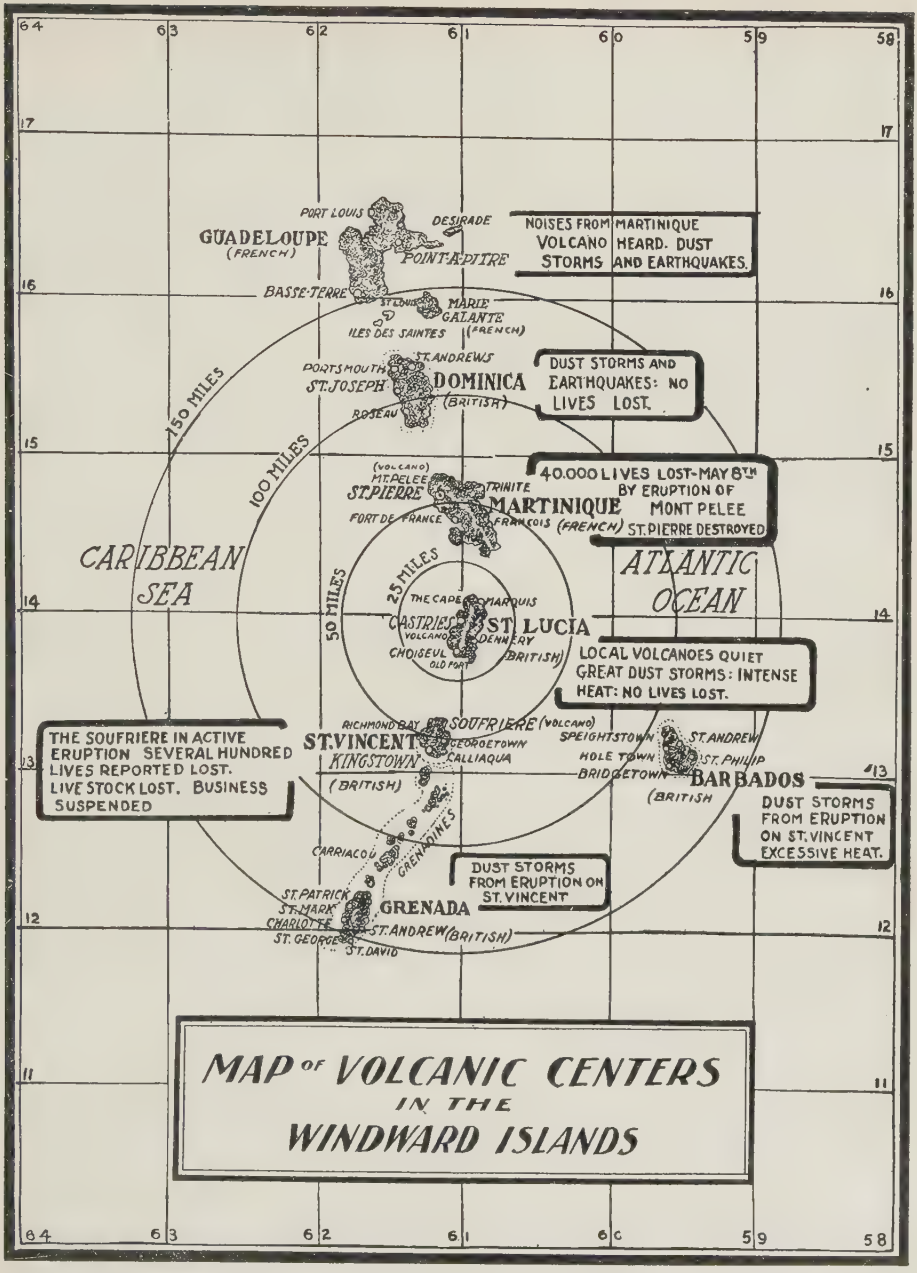
The tropic day had begun. In woods and gardens on the hillsides the flowers were opening to the heat; a few birds were shrilling, not singing, as with us, but calling to one another; on the walls that fortified the climbing roads against downbreak, quick and dainty lizards were scampering after flies; odors of orange and jasmin blent with the balm of morning and tonic fragrance of the sea. Peacefully rocking in their towers on the Cathedral de la Morillage the bells were humming their call to prayer, and the golden notes went abroad in waves, reaching to the palm-hid villages along the shore.

Chimneys were sending up incense to the domestic gods, and faint notes of unhurried life issued through doors and lattices. The sea sparkled blue and green, the clean surf tumbled musically against the esplanade, and in the roadstead a few vessels swung carelessly. Clumsy pelicans watched at the water's edge for food, and graceful, graceless beggars began their own employment by lining up along the warehouses to watch the horizon and boats and nap between conversations.

Just Before the Storm.

Hark! Above and beneath the pounding surf and ringing bells, a rumble. Only thunder. The rainy season will be here in two or three weeks, and showers are growing usual. The industries of kitchen go on; commonplaces of the street are in exchange; the yawning ones who sleep late because this is holiday are looking at the ceiling and meditating on the sad necessity of getting up.

Again, and louder, that pulsing sound, deep, long, stirring, vague terrors; and this time it does not stop. The rumble grows; a yellow light, a light that would come of a dying sun, not a sinking one, is upon St. Pierre, making it shadowy and uncertain. How close it is, and what sultriness is in the air! The birds are flying off. The very fish are uneasy, and are leaping from the water. The opaline gar-spite, that swim so near



ST. LUCIA BEING IN THE CENTRE, THIS DIAGRAM SHOWS THE DISTANCES BETWEEN THE ISLANDS. THE VOLCANO IN MARTINIQUE IS 100 MILES FROM ST. VINCENT.

the surface, with bird-like turnings of the head, are putting off to sea. The sailors in the offing are studying the sky with doubtings in their look.

People step into the streets to see why it grows dark. Horses are stamping in the stalls, and the dogs are whining. The rush of the Riviere Blanche is hot, strong and sulphurous. Clouds nearly always rest on Pelee, but not such clouds as these. See, they are rent with thunderbolts, and the gloom is deepening fast! Yet the bells ring on, and there is comfort in them. Take that comfort while you may, for it is nearly over. You, mother, kiss your little ones for the last time. Good father, in the church, commend the souls of those kneeling ones to the All Father, who is to require them, for the hour has come. To every one in St. Pierre this is the last of earth.

The Mountain Shaken.

Pelee lightens. It shakes from head to foot. A smoky pall descends, blotting the view of Niagaras of boiling mud that are leaping down the slopes. A very devil's tattoo is sounded from the cathedral. The bell man has done his work, and these rapid notes are the pounding of stones that shower from the sky.

On the steamer "Roraima" the crew and the passengers — West Indians, Americans, English, Germans, Swedes, Italians—who were eagerly questioning, are praying now. On shore there is a movement toward the churches. At the pretty wayside shrines men and women fall to their knees and bend their heads. And so comes death. The cloud, falling with the speed of hail, spreading as a fan, its edge rolling and volleying like a breaker. It is a green, sulphurous, poisonous, unearthly green, with a back ground of pitchy darkness. It reaches St. Pierre. In one breath the people die. In another moment the cloud turns to fire, with a cannon report.

Now the ash falls thick and hot, and stones from the crater break as they reach the ground with sparks as of coals. But human eyes do not see these things. They are glazed, and stare at vacancy. At one throb 20,000 human hearts have ceased to beat. St. Pierre? There's no such a place. Its citizens abroad are of the race of Ishmael, and homeless. Its streets will be peopled of the lizard and the fer de lance, and weeds and vines hide its ruin.

The rattle of stones is over, the crash of trees, swept from the ground in an inrush of cool air has ceased, from end to end the city is on fire, but will burn tranquilly till the rains fall, the shipping is in flames or sunk, less ash sifts from the clouds, and after a little there come up from the south black spots that, drawing near begin to wheel above the place of death. They are the vultures.

How the City Was Constructed.

Cities are not built in this country as in ours. An American town of 26,000 would spread over several square miles. We can take a place like Meriden, Conn., or Nyack, N. Y., as an example. Only the business district would be congested. But in these West Indian cities the building is continuous. The houses are detached rather than separated, by party walls, yet they stand close, and the new comer erects his house a hand span from his neighbor, if his wall does not actually touch the adjacent property.

And the houses are also small, more people rooming over twenty square feet than in many parts of New York. So,

although St. Pierre was a mere strip between the cliffs and the sea, extending for hardly a couple of miles, its population was dense and its commerce made it one of the busiest and most attractive cities in the Carribean. Pompeii was buried deeper and Pompeii was a richer, handsomer town, but the destruction of life was not a tithe of that in Martinique.

Lofty Volcano.

The Soufriere lords it over St. Vincent as Pelee does on Martinique, rising over 4000 feet above the sea. It has been quiescent since 1812. There were various warnings of trouble three weeks ago; the ground shook, rumblings were heard and a lake in the crater was discovered. On the 6th of May there were escapes of steam with great noises, and on the 7th three craters were pouring out mud that flowed down the slopes, covered with vapor and uttering stenches of sulphuretted hydrogen. Columns of cloud rolled upward to a height of eight miles, and others descended, carrying showers of dust and stones and burying the land under a mid nightdarkness and an appalling gloom.

The down-coming cloud was likened to flowers and heads of cabbage, leaves of vapor, miles long, incessantly shot through by webs and sheets of electric fire. Hot water flowed over the crater's lip and it is alleged that a glow as of molten lava shown against the under side of the clouds. But if there was lava it did not flow. Like Pelee, the Soufriere is a mud volcano. Laborers flying from the fields reported danger to the settlements and presently there were regular processions trudging along the roads toward Kingstown and other places out of reach of the bombardment.

For some time it was not known that lives had been lost, and the discovery that 2000 persons had perished in the infernal blast came with crushing force upon the little communities of the island and deepened apprehension which extends to the remotest confines. It is not that the people are all afraid of burial under ashes, but that in these great upheavals new craters break under one's feet and strips of coast slide into the sea, the submarine avalanches falling for hundreds of fathoms carrying villages and people to eternal burial.

Disaster Was Widespread.

The disaster on St. Vincent is more widely scattered than in Martinique. Most of the bodies that are not buried under ash and mud have been buried and cremated, though occasionally the odor from a deserted cabin shows the need of sanitary agents. A great epidemic has been foretold for the afflicted islands, but no tropical country ever before had so prompt and adequate a medical service to prevent it. The agency of flies, that made such mischief in the camp at Chickamauga must be taken into account.

On entering Georgetown last evening we encountered a throng of people gathered about the doors of a shabby shop, with pails, boxes and baskets. They were of all ages and both sexes, and they disclosed the same admirable patience that is shown in the hospitals. They were the applicants for relief.

At 9 o'clock last evening three hundred of the refugees who are quartered in and about the supply house on the main

street, were consoling themselves with hymns. Seated and standing in the windows and gathered on the rough pavement that has been drifted with the volcano's ash, they waited a leader. Some strong voice would begin, "Jesus Lover of My Soul," or "Nearer, My God, to Thee," and in a moment all the others would be joined in harmony.

Genius for Music.

The musical skill of these people is wonderful. There are no false chords or sharped or flatted intonations. Nobody has had singing lessons or has heard anything about correct breathing or method. All sing from the chest and the heart. The alto carried by some boys of nine or ten years, who do not know printed music from a prescription, is startlingly fine and true.

The moon was shining, the southern cross was sparkling in the sky, the surf droned along the beach, the camp-fires twinkled, the crickets chirped, the leaves of the banana tree rustled in the breeze and the music added the one element to make this a perfect tropic night. And think what this comfort of song means to a people so bereft, so lorn, so terrified.

And what a scene of desolation this sunlight falls upon! It was stern in the blackness of yesterday's eruption, but the white glare to-day lights new woes into being. Humanity stirs among the ruins again. A dredge came from Fort-de-France this morning with a few soldiers as guards and seventy-five or eighty negro laborers. They will not try to clear the streets. They will open a few safes to recover treasure, but chiefly they will burn the bodies that still lie under the tumbled walls and are half buried in the ash. There has been a rainfall over night, and where the dust kicked into the clouds about us yesterday to-day we plunge about in mud, the finest, the slimiest, most clinging mud you can imagine.

Everything reeks in it. A faint and faded stench of sulphur rises as we slosh about, tripping against sunken rocks, and one man slips on the edge of a retaining wall and tumbles into a yard fourteen feet below to the sorrow of his shins.

I don't know how it is that we make light of these matters or pretend to as we slip and flounder through the mire, but deaths we do not see will seldom haunt us, and some unfortunates who step into corruption that was alive the other day feel disgust and nausea rather than horror.

Odors of all Sorts.

It has been given out that an overwhelming evidence of decay is issuing from this spot. It is not so. At two miles off shore I notice it, yet when traveling over the ground it is at least partially submerged under a smell of burned material—the smell of scorched wood, paper, cloth, rugs, food, a general indescribable, foul and pungent odor.

Still, one locates cadavers easily by the nose, and a few are made sick by them. You pass to the leeward of a corpse and the proof of death is so persistent that you look in that direction. You see nothing, perchance, among the heaps of fallen masonry, prostrate trunks of palms, the iron fences and the rubbish of old tinware, covered as they are with gray, but if you have been among the like before you will know the signs.

The human body, even of a lean West

Indian, contains a considerable amount of oil. This oil has tried out in the torrid climate and soaked upward through the ash, so that you find the figure stretched upon the earth in brown. Wind has blown the ash from some of the forms, so that the faces are plainly distinguishable while in other cases the corpse is merely suggested to the eye.

Attitude of Rest.

In the cemetery I found one man whose position, excepting a slight lifting of the hands, was that of rest—the attitude of one who has thrown himself upon a grassy bank to sleep, the head thrown back, the arms extended, the legs apart. At a little distance was another lying face down. In the debouch of a narrow street was one that was half skeleton already, the bones showing yellow white through the cooked flesh, and green and shining flies crawling over the head.

Atop of a retaining wall, closing a yard that is eight or ten feet below the level of the impending terrace, lies a man with head hanging backward over the edge, and arms dangling over the stone work, too. The form is that of an Egyptian mummy, dried and blackenend, but the expression does not denote fear and pain, such as a few of the visitors allege they discovered on the faces of these dead. These I have seen denote calm.

The visitations of dust for some days preceding must have persuaded those who were watching the mountain that this was to be only a passing fall. It was not the dust that killed; it was gas, sulphuretted hydrogen possibly, and it made all who breathed it unconscious at the first inhalation. It was a merciful death.

Those lying beneath the wreckage were not killed by blows of falling stones and timbers. They had passed all feeling. The supposed keeper of the cemetery with his keys fell where he stood. One figure crouched beneath a gravestone as if he feared what was coming, yet his collapse in that position may have been an accident. In front of a house containing thirty bodies is a carriage, recognized as that of a rich merchant who left his fine estate among the hills on the night before and came here for safety. He is dust. His beautiful place on the heights remains. The body of a girl in one house has fallen easily before her piano, as if she were at practice that morning.

Lazy Workmen.

The negro workmen are mortally slow. They dawdle and talk, accomplishing less in a day than American laborers would do in an hour, though it must be said in their behalf that they have to contend not only against the severities of the sun heat but with the sting of the fire and the noisome exhalations from roasting carrion. Grotesque rather than terrible are the bodies as they peep from the timbers and the flames.

Although the gas which destroyed this population, the heat of the houses as they burned afterward, the heat, too, of the falling ash, which was like needle points of fire, scorched the bodies indoors and out, a few were partially preserved. One of the corpses that I found near the little park was first seen because of a foot protruding through the mud, and the bottom of this foot showed a skin typical of the negro.

An early visitor to the scene of the dis-

aster on opening the door of a bedroom found a woman and three children. The woman had fallen back on the rude couch that was her bed. Her pipe had slipped from her mouth and lodged against her breast. On a box at the head of the couch was a bowl of gruel and a fragment of bread. The children were lying one upon the other on the floor, and of this whole company it was only the child nearest to the door that had been scorched. Even the woman's single garment was not burned.

Man in an Oven.

One of the most curious finds was that of a reporter in our party. He went into a bakehouse containing two arched ovens. One of these ovens was empty. In the other was a man lying in an easy attitude on his back, feet at the door, arms extended and knees slightly bent. What possessed him to hide in the oven? In the tropics one seeks coolness, so he could not have gone there for sleep. He must have been terrified by the darkness, the oncoming dust, the hail of stones, but the sulphurous blast sought him even in that refuge.

Death here is grim enough, Heaven knows, yet in comparison with the reach of the devastation, single human creatures are small. The corpses are incidents. The destruction of a city that was an upbuilding of years of toil and a culmination of schemes of art and commerce, is more impressive and even sadder than those poor wrecks of flesh and bone deliquescing among the ashes.

The visual sign of ruin is so great that there is no comparison for it. One thinks of the burned districts of great cities, yet even here the likeness does not hold. In a burned district walls and chimneys will still be standing, a few windows will be intact, some streets will be clear, but in St. Pierre architecture does not exist; it is a place of foundations and rubbish, with not one pane of glass for miles. There is not a yard of clear street. It is as if a blast of dynamite had shaken the town asunder. Streets and lanes lead nowhere, and the pathos is heightened by the names and numbers, stamped on metal in blue enamel—futile guides, read only by ghosts.

To stand in one of the streets, like the Rue Victor Hugo, formerly lined with attractive shops and gay with color, and see it now, with skeletons of houses on either side, the windows staring like sightless eyes, the doors gaping like suffocated mouths, the pavement heaped with stones, to note the fixity and silence, is to stand in the presence of death—death enthroned in fire and cloud, wielding thunders and breathing poison. The world has no other spectacle like that in Martinique to-day.

Buildings Utterly Wrecked.

So complete is the destruction that little remains to mark the character of the buildings. The parallelogram of masonry, scarred, blackened, dust covered, might be a house, a stable, a shop, a factory, a church, a jail. Now and again there is a yard or court, with flower pots or a fountain that denotes a former home of the moneyed resident, but which was his house, which his office, which his carriage shed, which his servants' quarters, is mere guess.

And this wide throw down of walls and

blocking of streets makes it hard to estimate the size of the city. There is no doubt that the first reports of the fatality were exaggerated. They put the loss of life at 40,000. So near as one may learn from the imperfect methods and imperfect records, the populatian of St. Pierre was 26,000, and the outlying villages which were destroyed at the same time added but a few hundreds.

GREAT VOLCANIC ERUPTIONS.

IF Kilauea, in Hawaii, is not so high, it has the distinction of a crater, which, for size, is without an equal. A large city like Buffalo or Omaha could easily find room within its bounds. Its eruptions are the most tremendous of any similar chimney of nature on the globe. While it is always active, there are certain periods when the internal fires cause the lava to boil over.

Premonitory symptoms indicate the coming of an eruption. Ordinarily, the lava surface lies from 1200 to 1500 feet below the surrounding crater, but when an eruption is near at hand little by little the lava creeps up until within 600 or 700 feet of the rim, then comes an explosion, the lava boils over and runs off down the side of the mountain.

This is its usual course, but on several occasions Kilauea has diversified matters by sending off its lava underground, the intense heat melting the stones of the island and the current of lava thus flowing off, sometimes for fourteen or fifteen miles ere it forces its way to the surface.

After it does so its course is exactly that of other lava flows, sweeping onward in a resistless stream, devouring everything in its pathway, and finally plunging into the sea, sending up, as it does so, clouds of steam which continue to rise sometimes for months after the eruption has ceased, and causing phenomena that are a wonder to all beholders.

Many notable eruptions of Kilauea have occurred, but the greatest of all since the island was known to Europeans was that of 1840, when a lava stream forced its way underground for 27 miles, then appeared upon the surface and traveled 13 miles farther, finally pouring into the sea The coast was extended for a quarter of a mile ; the stream flowed for three weeks, and varied in width from 500 yards to 3 miles, and in depth from 50 to 200 feet, according to the ground. It was estimated that the amount of lava poured out on this occasion was 15,400,000 cubic feet, an amount which would build Vesuvius and leave material to spare.

Mauna Loa, sixteen miles from Kalauea, has a terminal crater 14,000 feet above the sea, and 8,000 feet in diameter. Mauna has an individuality of its own, for while Kilauea furnishes a quiet flow of cosmic material, Mauna exhibits fireworks. During eruptions of this gigantic mountain, fountains of fire play from its summit, jets of molten lava flashing with every color of the rainbow, spouting from 200 to 500 feet in the air

In 1859 there was such a display, the lava fountain, a gigantic stream, playing continuously for several days, and much farther than the mountain, was itself visible. The eruptions of Mauna Loa and Kilauea sometimes occur contemporaneously and sometimes one is quiescent while the other is active. Underground lava flows

have been credited to Mauna Loa, which properly belong to Kilauea.

So the great flow of 1868, which traveled underground, charring the surface wherever it went, may have come from Kilauea as well as from Mauna Loa. Each has made substantial additions to the area of Hawaii, for at a score of points along the coast the lava cliffs and twisted streams of molten stone appear in the sea far beyond the normal line of the shore.

Tremendous as are the activities of the two great volcanoes of Hawaii, there is evidence of a much greater force in the past, for the islands contain not only the largest active crater in the world, but the greatest extinct chimney, that of Mount Haleakala, the rim of which is over 10,000 feet high, and the crater itself 27 miles in circumference and 2,000 feet in depth.

Vesuvius might be set down in the crater of Haleakala, and the tip of the famous Italian volcano would not appear above the rim. Stromboli might be added and still the summit of the latter would hardly be visible. This great extinct volcano is three times the size of Etna, and when it was in active operation must have furnished eruptions and explosions compared with which that of Krakatoa, the most tremendous on record, was but a trifle.

PICTURESQUE VIEW OF LAKE TAUPO AND VOLCANIC MOUNTAINS, NEW ZEALAND.

New Zealand is an Island of volcanic

features. We present a picturesque view of one of the lakes, with fiery volcanoes near its shore, forming a scene of natural sublimity.

HEIGHT OF TWENTY-FOUR OF THE LOFTIEST VOLCANOES.

Name of Volcano.	Height in feet.	Where Located.
Sahama	23,000	Peru.
Llullaillac	21,000	Chili.
Arequipa	20,500	Peru.
Cayambi	19,813	Ecuador.
Cotopaxi	19,500	Peru.
Antisana	19,200	Ecuador.
San Jose	18,150	Chili.
Mt. St. Elias	17,900	Alaska.
Popocatepetl	17,884	Mexico.
Orizaba	17,370	Mexico.
Altar	17,126	Ecuador.
Sangai	17,120	Ecuador.
Klintcheoskaia	16,512	Kamtschatka.
Iztacihuatl	15,700	Mexico.
Toluco	15,500	Mexico.
Shasta	14,400	United States.
Fujiyama	14,000	Japan.
Mauna Kea	13,953	Sandwich Isles.
Mauna Loa	13,760	Sandwich Isles.
Teneriffe	12,236	Canary Islands.
Mt. St. Helens	12,000	United States.
Mt. Hood	11,225	United States.
Peak of Tahiti	10,895	Friendly Isles.
Mt. Etna	10,874	Sicily.

Three of the best known volcanoes of the world, Vesuvius, 3,978 feet; Hecla, 3,970 feet, and Stromboli, 3,000 feet, are of much less elevation than many others altogether unfamiliar.

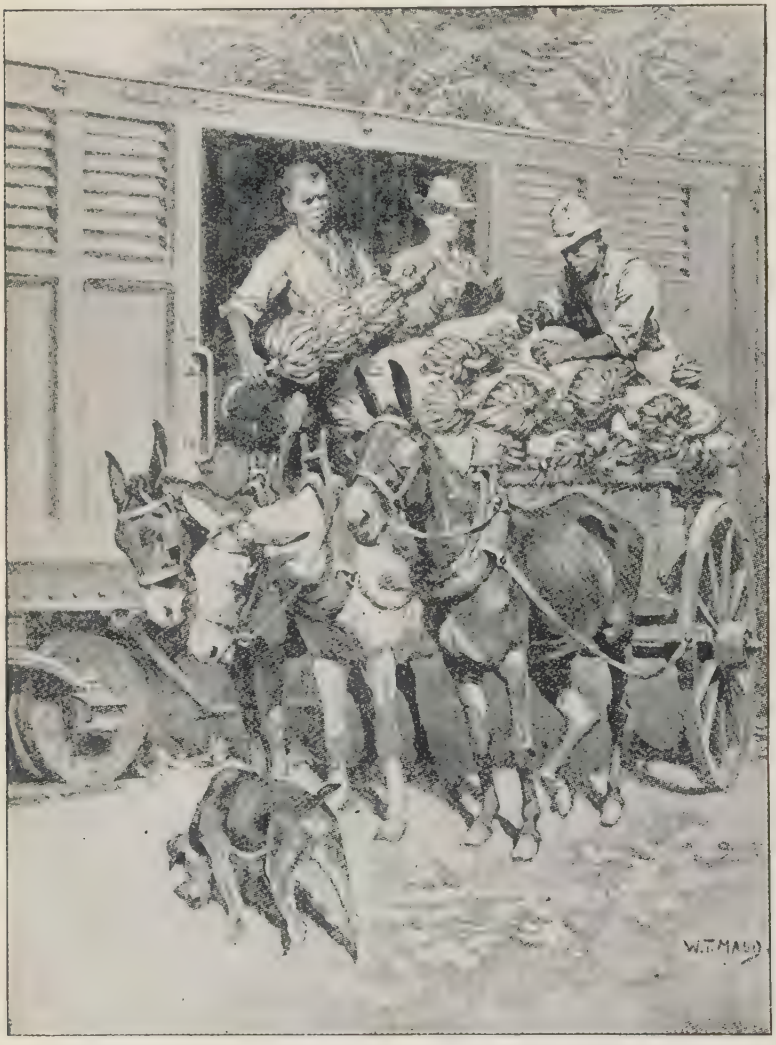
JAMAICA'S VEGETATION

Great Variety of Luxuriant Tropical Fruits—Large Export Trade in Bananas.

THE greatest length of the Island of Jamaica is 144 miles; the greatest breadth, 50 miles. The island is traversed from east to west by the Blue Mountains, which rise to 7,400 feet. From this range nearly 120 streams descend to the coast, but owing to the shortness and steepness of their courses they are not navigable, with the exception of the Black river, which affords, for small craft, a passage into the interior for thirty miles.

Excellent harbors are everywhere to be ound. Incomparably the best of these is Kingston harbor, a deep and capacious basin in the southeast quarter of the island. Jamaica is believed to be rich in mineral wealth, but no minerals are extracted. On the whole, the island

is very healthy; invalids even come from the United States to enjoy the benefit of the salubrious air of the interior. There are two rainy seasons, one in the middle of spring and the other towards the middle and end of summer. In the latter the rains are exceptionally heavy; violent thunder-storms are frequent, and hurricanes sometimes occur. A cyclone in 1880 did damage of more than $5,000,000.



NATIVES OF JAMAICA LOADING BANANAS.

The vegetation is very luxuriant. The primeval woods are rapidly disappearing, yet there are still many valuable trees such as balata, mahogany, logwood, lignum vitæ, fustic, ebony, pimento, cocoa-nut and other palms, cactuses, etc. Tropical fruits are grown in great variety, also many of the fruits of more temperate climes. Spices, dye-woods, medicinal plants, and food plants such as vinegar, cochineal, castor-oil, arrow-root, maize, vanilla, pimento (allspice), etc., are extensively grown.

A large extent of the cultivated area (one-fifth) is devoted to the growth of Guinea grass. This and pasture lands occupy the greater portion of the north and west of the island. In the south and east the principal crops are sugar, coffee, vegetables and fruits. A little cinchona and cacao are also grown. The mongoose imported to prey on the rats that infested the sugar estates, has after exterminating the rats, become a plague, and has nearly extirpated lizards, harmless snakes, and small birds, so that insect pests abound. This is more or less true of all the so-called tropical countries.

The negroes, who are mostly small holders, are the chief growers of the fruits. The exports, which consist chiefly of dye-woods, fruits (oranges, lemons, bananas, pine-apples, etc.), sugar and rum, coffee, ginger, allspice, and cocoa, average fully 1½ millions annually; whilst the imports, consisting of food stuffs, clothing, hardware, liquors, coals, building material, etc., reach pretty nearly the same value. About 40 per cent. of the trade is with the United Kingdom, and the share with the United States 43 per cent.

Jamaica was discovered by Columbus in 1494, and taken possession of by the Spaniards in 1509. The island was formally ceded to England by the treaty of Madrid in 1670. The place of the native Indians was taken by negro slaves imported by the Spaniards, and by Irish and Colonial immigrants who arrived soon after the capture of the island. During the eighteenth century more than half a million slaves were brought over from Africa.

Frequent Rebellions.

Under English rule, the chief events in the history of Jamaica were frequent rebellions of the Maroons, a community of runaway slaves, who had obtained a tract of land on the north side of the island; 1831-2 a negro insurrection; and on August 1, 1834, the emancipation of the slaves by England, Jamaica receiving $30,824,635 as her share of the compensation money. The chief result of this last event was to ruin the sugar growing of Jamaica, principally owing to the difficulty of procuring labor. The negroes would not work, now that they were free. They sought to obtain land without rent. The more violent even suggested the expulsion of the whole white population of the island.

In 1865 the discontent was at its height. In October of that year the negroes rose in revolt and massacred twenty-three whites. Martial law was proclaimed and the uprising was suppressed with great vigor. A new constitution was framed in 1866, under which the island is now governed by England like an ordinary crown colony. Crime has diminished and education has everywhere advanced among the black population.

Products of Jamaica.

A collection of Jamaica products was exhibited with very satisfactory results at the Philadelphia Exhibition of 1876, and also at the World's Fair at Chicago in 1894. Tropical fruits of various kinds are grown in Jamaica. Our engraving represents the natives of Jamaica loading bananas.

The bananas are all cut not more than twenty-four hours before the ships sail, in order that they may not ripen too quickly. The cutting of 20,000 bunches of bananas and their prompt delivery alongside the ship for transport entails a considerable amount of organization on the part of the planters and of the railway company. Directly the order for the fruit arrives, gangs of coolies and natives make for the plantations and cut the fruit, which is brought down to the vans on the railway by two-wheeled carts drawn by three mules. Each bunch of bananas is wrapped in canvass to protect it from being bruised, and also from the rays of the tropical sun. A strict account of the bunches delivered is kept by a railway employe.

GREAT CANALS OF THE WORLD

Isthmian Canal Connecting the Atlantic With the Pacific—Waterways Indispensable to Commerce—Famous Suez Canal.

IN view of the construction of thegreat Isthmian Canal, the following information in regard to other great canals will be of interest. The artificial waterways which may be termed ship canals are nine in number.

1. The Suez Canal, begun in 1859 and completed in 1869.

2. The Kronstadt and St. Petersburg Canal, begun in 1877 and completed in 1890.

3. The Corinth Canal, begun in 1884 and completed in 1893.

4. The Manchester Ship Canal, completed in 1894.

5. The Kaiser Wilhelm Canal, connecting the Baltic and North Seas, completed in 1895.

6. The Elbe and Trave Canal, connecting the North Sea and the Baltic, opened in 1900.

7. The Welland Canal, connecting Lake Erie with Lake Ontario.

8-9. The two canals, United States and Canadian, respectively, connecting Lake Superior with Lake Huron.

The description which is given of each of these great waterways shows that the length of the Suez Canal is about ninety miles; the cost, $100,000,000; the present depth, thirty-one feet; width at bottom, 108 feet, and at the surface 420 feet, and that the number of vessels passing through it grew from 486 in 1870 to 1944 in 1875, 2026 in 1880, 3389 in 1890 and 3441 in 1900.

The Kronstadt and St. Petersburg canal, which gives a passageway for great vessels to St. Petersburg, is sixteen miles long, including the deepening of the bay channel, 20½ feet in depth, and the total cost is estimated at $10,000,000.

The Corinth canal, which connects the Gulf of Corinth with the Gulf of Aegina, is four miles in length, 26¼ feet in depth, 72 feet wide at the bottom, cost about $5,000,000, and reduces the sailing distance 175 miles.

The Manchester ship canal connects Manchester, England, with the Mersey river and Liverpool. Its length is 35½ miles, depth 26 feet, width at bottom 120 feet and at the surface 175 feet, cost $75,000,000.

The Kaiser Wilhelm canal, which connects the Baltic and North Seas through Germany, is 61 miles in length, 29½ feet in depth, 72 feet wide at the bottom, 190 feet wide at the surface, and cost about $40,000,000. An additional canal connecting the same bodies of water by way of the Elbe and Trave rivers was opened in 1900. Its length is 41 miles, depth about ten feet, width 72 feet and cost $6,000,000.

The North Holland canal, which connects Amsterdam with the sea, cut in 1845, but deepened at a later date, has now a depth of 20 feet and a width of 125 feet at the surface. The Caledonian canal, which connects the Atlantic and North Sea, through the north of Scotland, is 17 feet in depth, 50 feet in width at the bottom 250 miles long, cost $7,000,000, and at its highest point 94 feet above sea level. The Canal du Midi, cut through France from Toulouse, on the Garonne, to Cette, on the Mediterranean, a distance of 150 miles, is six and one-half feet deep, 60 feet wide and 600 feet above sea level at its highest point, and has 114 locks; total cost, $3,500,000.

ARABS VIEWING THE PASSAGE OF A VESSEL THROUGH THE SUEZ CANAL.

In America the canals connecting the great lakes are the principal shipcanals, and are three in number: the Welland canal, originally constructed in 1833 and enlarged in 1871 and 1900; the Sault Ste. Marie, or St. Mary's canal, opened in 1855 and enlarged in 1897, and the Canadain Canal at St. Mary's river, opened in 1895. The American and Canadain canals at St. Mary's falls are practically identical in location and dimensions, and are used interchangeably by vessels engaged in commerce, as convenience may dictate. The depth of the canals at St. Mary's river will accommodate vessels drawing twenty feet of water.

The American canal was originally constructed by the State of Michigan, but subsequently taken charge of by the United States and enlarged at a cost of $2,150,000. The cost of the Welland canal was about $30,000,000, largely due to the fact that twenty-five locks are required in surmounting the rise of 327 feet in the distance of twenty-seven miles.

The number of vessels passing through the canals at St. Mary's river has greatly increased in the past few years, while the number passing through the Welland canal has materially decreased; the number passing through the St. Mary's canals being in 1873, 2517, and in 1901, 20,041, of which 15,837 passed through the United States canal and 4204 through the Canadain. The number of vessels passing through the Welland canal decreased from 6425 in 1873 to 2202 in 1899.

The marked contrast between the business of the St. Mary's Falls and Welland canals is largely due to the fact that the freights originating in the Lake Superior district are chiefly discharged at Lake Erie ports, and those destined for the Lake Superior region are chiefly produced in the section contiguous to Lake Erie, the Lake Superior freights being chiefly iron, copper and grain, and the Lake Erie freights for Lake Superior coal and manufactures.

The business of the St. Mary's Falls canals far surpasses in volume that of any other canal of the world, the freight tonnage of the American and Canadian canals combined being in 1901, 24,626,976 registered tons, while the net tonnage of the Suez Canal in 1900 was 9,378,152 tons, and that of the Kaiser Wilhelm canal 4,282,094 tons.

The steamer "Ophir" carried the Prince of Wales, heir-apparent to the throne of England, and the Princess, on their visit to the British Colonies in 1901. The passage through the Suez canal was delayed by an accident, but the Suez canal is so interesting a sight that this proved no stumbling block to pleasure.

The dark figures of picturesque Arabs flocked from far and near to view the white ship which bore the future king of England to his southern empire, and the royal party was fascinated and enchanted by the romantic and picturesque appearance of these sons and daughters of the East.

THE PANAMA CANAL.

THE concurrence of the House of Representatives in the action of the Senate adopting the Panama canal route, if the President can secure a clear title to the same, while not absolutely determining the route, apparently assures the construction of a waterway destined to be of incalculable importance to the commerce of the United States and of the world. The project has been under discussion for years. Few subjects have been more thoroughly debated in Congress. There has been hesitation in deciding upon a route, but none as to the advisability of constructing an interoceanic waterway.

The bill, as passed, provided that the President should obtain a clear title to the rights and property of the Panama Company. If a satisfactory title be secured the President was authorized to acquire

for the United States, at a cost not exceeding $40,000,000, all the rights, franchises, concessions grants of land, right of way, unfinished work, plants and other property owned by the Panama Company, its plans and drawings, its capital stock, and the shares of the Panama Railroad Company held for the use of the canal company.

Right to Own and Operate.

Authority was given to acquire from the Republic of Columbia exclusive and perpetual control of a strip of land, not less than six miles wide, from ocean to ocean, the right to operate and protect the canal, and the right to maintain and operate the Panama Railroad, if a controlling interest in the road shall have been acquired by the United States.

The United States is to have jurisdiction over the strip and the ports at the end thereof, and the right to make necessary police and sanitary regulations, and to establish judicial tribunals to enforce the same. The canal is to be of sufficient size to afford convenient passage for ships of the greatest tonnage and draft now in use. Safe harbors shall be constructed at the entrances to the canal, and such defensive works as may be necessary for their protection. Should the President be unable to secure a satisfactory title to the Panama route he has power to proceed with the construction of a canal along the Nicaragua route.

The cost of acquiring and completing the Panama canal, it is estimated, will be less than the cost of constructing the Nicaragua project; but other considerations assist in determining the choice in favor of the Panama route. Among them is the lower cost of operating the Panama canal. Admiral Walker estimated that the difference in favor of the Panama route would be $1,300,000 a year.

The conviction that the construction of the Panama canal would prevent the construction of a competitive interoceanic canal had much influence. The presence of a railroad along the Panama route is an obvious advantage. The exposure of the Nicaragua route to volcanic disturbances could not be ignored. When the route is finally fixed by the action of the President and his advisers, in pursuance of the act, the work will be pushed to completion with the energy, thoroughness and speed that usually characterizes American enterprises.

The Cost.

The question of constructing the Isthmian canal by this or that route is one of dollars and cents in first cost, cost of operation and commercial availability. The ascertained facts and estimates in regard to the two routes may be set forth in the form of a table, as follows:

	Panama.	Nicaragua
Length of canal navigation, miles	42.09	141.88
Total length	49.09	183.66
Depth of great cuts, feet	103	297
Excavation, cubic yards	94,863,703	227,711,605
Steel in construction, tons	32,624	40,500
Number of locks	5	8
Length of nav. around curves, miles	22.85	49.29
Hours of passage	12	33
Hours of passage in daylight	21	64.30
Average rainfall, inches,	129	265
Cost	$184,233,358	$189,864,062
Cost of maintenance, annual	2,000,000	3,300,000

Congress voted $180,000,000 to be applied to an isthmian canal, and provided against any possible failure of this fund by an issue of bonds if it should ever become necessary. No other government has ever made such an appropriation for a work of a civil or commercial character to be located in a foreign country and intended only to foster commerce and to promote peace, civilization and progress in all Christendom, and ultimately to draw the other nations into the grand upward movements towards higher planes of development.

This appropriation will never be repealed, and an isthmian canal will result from its expenditure.

The first great revolution that it will cause in the commerce of the world will be slow, but inevitable. It will transfer the clearing house of the world's commerce from Liverpool to New York.

The hemisphere that is Christian from pole to pole, without any dissenting nation to provoke religious wars, is entitled to the lead in the march of civilization, and is now moving to the head of the column. The removal of the isthmian barriers clears the way, and the remainder of the movement will be a triumphal procession in which all nations will join under the banners of peace.

The basis of the calculation as to the net earnings of the isthmian canal is well established in the history of the financial operation of the Suez canal. That canal is 100 miles long and cost $150,000,000, including the enlargements. Its net earnings are distributed on the basis of the par value of the original stock, about $100,000,000. The net earnings have been from 15 to 18 per cent.

The wealth of the area that supplies this income to the Suez canal is not one-half of that which is tributary to the American isthmian canal. The logical deduction is that we can earn more money at $1 per ton for tolls on shipping than the Suez canal can earn at the rate of $1.50 per ton.

QUEER ANIMAL FREAKS

AN expedition sent by the Smithsonian Institution to Cuba, for the purpose of collecting strange animals and plants, returned with a wonderful assortment of curiosities. Its members met with many adventures, the most weird of which perhaps was an encounter with multitudinous white bats in a cave one hundred feet under the ground.

Giant lizards of great ferocity and rats of an edible kind, three feet in length, were caught, and the former shipped alive to Washington, while the latter furnished fresh meat for the party. Various queer species of birds and insects were secured, including some of the largest tarantulas and scorpions in the world.

Mr. William Palmer, who led the expedition, thus describes it:

"Our natural history exploration was

restricted to Western Cuba. We made a camp at Pinar del Rio, in the province of the same name, and from there made trips into the mountains and to the coast. Next we went to San Diego de los Banos, using that place as a base of operations in the same way, thence to Guanajay, and from there along the north coast westward. Finally we visited the south coast of Havana Province and the Isle of Pines.

"We brought the great lizards alive from the Isle of Pines to Havana and shipped them to Washington in boxes lined with grass. A number of snakes were forwarded in the same way, but done up in cotton bags inside of the boxes, the main idea in transporting such animals being to avoid rubbing. Thirty-two little crocodiles, too, we secured alive, and fifteen of them are now at the Zoological Park here, where they will doubtless grow up in the course of time and furnish a cheerful attraction.

Immense Lizards.

"Of the big lizards called iguanas we got two fine specimens, one three feet long and the other half a foot longer. I am going to kill the larger one and make a cast from it, afterward painting the cast to imitate life as closely as possible, with the help of the smaller one for a model. The latter may then go to the Zoo. In Cuba one finds these reptiles crawling about on the ground in the woods, where they subsist on leaves and fruits.

"They are extremely fierce, and the big ones can bite very severely. Those I caught were taken with a noose of string on the end of a pole. I kept a piece of cord handy in my pocket, and when I came across one of the creatures I made a noose, attached it to the end of a stick and approached the iguana cautiously. As soon as I had the noose over its head I gave a jerk, and so had it dangling. It was easy enough then to imprison it in a box. Down in Cuba they eat the big iguanas, and because they are eaten so much they have become rare. Snakes used likewise to be abundant on the island, but during the late war the starving people ate them up.

Monstrous Bats in Cuba.

'Cuba is a great place for bats, and we had some exciting times catching them. There are more than thirty species of these winged mammals on the island, and we secured about fifteen species, some of which were hitherto unknown. One species has been known only by a single type specimen in the Berlin Museum, but we brought back a complete series to illustrate it, comprising both sexes—adults and young ones. Some of the Cuban bats have very long tails and others surprisingly short tails, while others yet have no tails at all. Some species have sharp teeth and live on insects, like our own bats, while others, with stumpy teeth, are fruit eaters.

"We got most of our bats in dry caves in the mountains, but in order to obtain a certain rare white species we were obliged to go into a cavern a hundred feet under ground, where it was wet and terribly hot. The passage we went through first descended, then ascended, and again descended, having a form like that of a siphon. In a chamber at the curve of the siphon, in the high part of the passage, we found the bats—at least ten thousand of them, I should judge.

The smell was horrible and the perspiration ran from us in streams.

"Perhaps the most interesting animals we found were huge rats, of a kind which attain when full grown a weight of eighteen pounds and a length of three feet, including the tail. The biggest one we got, however, weighed only ten pounds. These rodents live chiefly on the bark of certain trees. They belong to the genus Capromys, and, though sure enough rats in a popular sense, they are more nearly related to the guinea pig.

Their Peculiar Flavor.

"We ate a great many of them, not because we found them very appetizing, but for the reason that they were the only fresh meat we could obtain. Sometimes we cooked them ourselves, and sometimes we turned them over to a Cuban native, who was always glad to get them, and dined with him. The flavor of the meat is peculiar, and not very nice; it was a bit repulsive at the start, but we got used to it.

"There are two species of these rodents in Western Cuba, and they are known to the natives as 'hutias.' Both species climb trees, but the smaller one is almost entirely arboreal, and has a prehensile tail, by which it hangs from a bough like a monkey. Americans on the island usually mistake the animal for a monkey. The larger species live mostly among rocks.

"We hunted the creatures with dogs, caught them in traps and shot them in the trees. Sometimes the dogs would tree one and it would run into a hole in the trunk. Then we would send a Cuban up to make the hole bigger, and eventually the animal would be dug out with a machete. We got one albino hutia, which was quite a notable freak. The mango swamps along the coast are full of these big rodents.

"Barring the bats, there are only four species of mammals in Cuba. Two of these we found in the western part of the island—namely, the two kinds of hutias, both of which have long tails. In Eastern Cuba there is one species of hutia which has no tail at all, and also in that part of the country occurs the solenedon, which is a very odd sort of beast, representing an extremely ancient type of animal found only in Cuba and Hayti, and nowhere else in the world, though it has a relative in Madagascar. It is related to the moles and shrews, feeds on insects, lives under roots and rocks and looks somewhat like an opossum, with a white face and long whiskers.

Beautiful Cuban Birds.

"We brought back a good many interesting birds. There are about three hundred and fifty species of birds known in Cuba, and of these perhaps one-half belong there, while the other half are migrants, spending only a part of their time on the island. Some of the native birds are gorgeously colored—as, for example, those of a genus of trogon, which is confined to Cuba. These trogons make their nests in holes in trees, and I got one of their eggs out of a hole in a tree that grew in salt water. The 'tody,' of a family that is close to the kingfishers, is small, but adorned with feathers of rose, red and green. Several species of woodpeckers are likewise very brilliant.

"Cuba has a robin which is bigger than ours, and a good singer. Also there is a kind of quail, darker in color and much more brilliant than our quail. Our kingbird has a much larger representative on the island, where are also to be found sparrows with yellow throats and other sparrows which are black with white spots on the wing. The black sparrows are good singers and the natives catch them for cage birds, selling them for a dollar. One of the most interesting birds is a great cuckoo, with a tail a foot and a half long. It is brown and has a harsh guttural note. Its body is small, but its wings are so big and its tail and neck are so long as to give it an appearance of considerable size."

PICTURESQUE WATERFALL.

MINNESOTA is an Indian name, signifying "sky-tinted water." The area of the State is 83,530 square miles, or nearly as large as Great Britain. In Minnesota are the remote sources of the great rivers Mississippi, Red River of the North and St. Lawrence, whose waters, flowing in different directions, reach respectively the Gulf of Mexico, Hudson Bay and the Atlantic Ocean. Within the State the Minnesota River is the largest tributary of the Mississippi. Between the St. Croix River and Red River of the North are hundreds of clear lakes, the largest of which are Red Lake, 530 square miles, Mille Lecs and Leech Lake.

About two-thirds of the State is prairie, but in the northern portion there are extensive pine forests, and in the northeast great marshes, bearing a scanty growth of tamarack and fir. The minerals include iron, which is profitably worked, slate, granite and other rocks and the red pipestone. The climate is bracing in winter—very dry and equable. The rainfall is sufficient and well distributed throughout the year. Minnesota is an agricultural and especially a wheat-producing state. Its manufactories as yet are principally flour and lumber mills.

Minnesota was visited by French explorers in 1659-60, and the portion west of the Mississippi was part of the province of Louisiana, purchased by the United

States from France in 1803. Fort Snelling, at the mouth of the Minnesota River, was built and occupied in 1821. In 1837 the Chippeway Indians surrounded all land east of the Mississippi. Immigration then began, and Minnesota became a territory in 1849, a State in 1858. It claims the distinction of having, through its Governor, offered the first regiment for the defence of the Union; and during the Civil War out of 40,000 citizens able to bear arms it sent 24,000 into the army.

In August, 1862, occurred a terrible massacre by the Indians, who attacked the frontier settlements and in ten days killed some 800 men, women and children. As a consequence, the Sioux and Winnebagoes were removed from the State, and their hunting grounds are now occupied by farms and prosperous towns. The principal cities are St. Paul, the capital, Minneapolis, and Duluth.

Our illustration shows the beautiful Falls of Minnehaha. While not so grand and imposing as some other great cataracts, their picturesque beauty is universally admired, and additional interest is derived from the name celebrated in Longfellow's poem, Hiawatha.

MINNEHAHA FALLS, MINNESOTA.

There are many parts of our country that are remarkable for picturesque natural scenery. Nature has been so bountiful toward us and our natural wonders are so many that they do not receive the attention and admiration to which they are entitled.

Beautiful Models in Clay

How the Costliest Furniture is Carved—Decorations Fine Enough for Palaces.

THE venerable art of woodcarving cannot be degraded to a simple mechanical process, even by the best devices of modern ingenuity. Sculptors of talent are still needed to form models in clay of every figure that is to be reproduced in the well-grained oak. It is true that after these artists have done their part machinery is used, and in a most interesting manner, too. But the beauty and real value of the creation owes all to the hand of the modeler.

Hidden away in the by-streets of the older part of Philadelphia—in its veritable Bohemia—are the shops where elaborate carvings are made. It it a curious and little known phase of human industry.

Carved tables, doors, newels, or whatever else of useful furniture you please to name, are all conceived here in the head of the sculptor. That artistic conception finds its first expression in the clay model, made with as much painstaking care as if it were to be the original of the most wonderful statue in the world.

The modeler sits at his bench and with slender tools scrapes and dents the great mass of mud before him, for mere mud it is, until it takes form and graceful shape. In a studio which might have been transplanted from the Latin quarter of gay Paris this quiet artist labors. All the carvers are men of education and practice, many of them familiar with the best ateliers of Rome and Paris, and to whom the language of the Faubourgs is almost as familiar as that of Chestnut street.

In the quaint old workshop, hung round with hundreds of once-used models, and into which the sun's rays filter through a great overhead skylight, these men work in almost unbroken silence. The surrounding casts—heads, nude figures, bodies of grotesque animals—are the stock of the establishment. These are not the best examples of art, for models intended to supply private customers and for special designs are destroyed when the "job" for which they are created has been finished. The rubbish pile sees the broken remnants of the sculptor's realized dream when the carving machine is done with it.

The finished design in clay is accepted or rejected—changed, modified, altered here and there until the customer is finally suited. It is then covered with a thin blue film of plaster, which is made thicker and thicker until it is considered strong enough for the purpose. When this outer coat of plaster has hardened,

the soft clay original is scraped away from within, and the space it had occupied is again filled, this time with plaster of a white color, to distinguish it from that of the outer shell.

This inner plaster cast is then allowed in turn to harden inside the first shell. And when it has "set"—which it does to the hardness of stone—skilled workmen chisel away the shell, leaving the inner cast firm as a rock and fashioned exactly like the original model.

Ingenious Contrivance.

This plaster model is then sawed into strips of convenient size, and it goes to the machine—a very intricate and ingenious contrivance. Operating a chisel at one end, this machine follows the precise lines of the model, which, lying under the "guide," alters and governs the direction and depth to which the chisel cuts.

When the automatic sculptor has done its work (after all this is only the rough part of the carving), the wooden pieces go to the hand workmen, who with small instruments, finish to a nicety all that needs to be done to perfect the original design. This is the hand carver's triumph, wherein he shows how the eye and hand of man cannot be supplanted by any mechanical device.

The houses of the wealthy bear many evidences of the modest wood sculptor's talent. Piano cases, doors, panels, balustrades, tables—all are made for the rich, and are constantly being added to as the rich increase and multiply in this land of millionaires. In the little forgotten street, where rich no longer dwell, and where squalor is a near neighbor, this fine, artistic community has its home, and does its work day after day and week after week.

And the modeler in clay, the fine-faced fellow whose finished conception stands in the hall of the millionaire, what of him? Is he a lost artistic soul in the great city? By no means. He has his fellows and his clubs and his quaint home and his wife and babes and a good, round salary. He never intrudes upon the millionaire in the latter's club or in the latter's house, and so he never again sees the table or shelf or sideboard he designed. But in his own circles he is a happy fellow, living in an atmosphere of art and with a degree of enjoyment which many a giant of commerce might well envy.

Models of Men and Women.

About him there radiate the artist models—men and women—whose forms he fastens in his designs, though he ignores their features. Others of the world of art or letters are his companions, and the theatre his almost nightly resort, where the upper "circle" is his home after dinner and until the curtain falls.

These modelers, designers, sculptors and "finishers" thus form an interesting community by themselves—sharing in common their joys and successes and helping one another to bear their trials and failures. There is a round of informal dinners in studios, occurring twice a week, at which two dishes have great vogue and almost exclusive triumph.

One of these is a beefsteak pudding, the secret and mystery of whose composition has been brought from Great Britain, and whose structure lends itself especially to Bohemian informality. The other

is "toad-in-the-hole," a composition of country sausage and Yorkshire pudding—once tasted, never forgotten. For table the "mixing board," on which the artist's clay is mixed with water, does general service, with all the traces of the day's burden skilfully removed. Napkins are as impromptu as the rest, with a special exception in the case of the Japanese paper affair, said to be less stiff and more satisfactory than mere newspapers.

Let it be owned to the sorrow of those who fancy all artistic genius buds best in a garret, that some live in well-to-do quarters, while others, less select in their tastes, dwell in the more retired but none the less respectable districts. These last are the men of family.

The Costliest Wood.

It often takes a sum of money equivalent to many weeks' salary of the sculptor to buy one of the finished products of his design. The wood alone from which it is carved is very old, very thoroughly seasoned, very rare and very thick. This costs a large price.

Then there is the infinitely patient labor, the progressive stages of which have been partially described. Thousands of dollars sometimes go to pay the cost of an article—a table, an escritoire, a paneled wainscot, a door!

Modern building operations, public and private, have given a tremendous impulse to the business, and there is a demand, almost impossible of being filled, for the product of the wood carver's art. The growth of private fortunes, or, more exactly, their multiplication, has resulted in the erection of many new private residences, each of which calls for a quota of fine wood carving. But, while artisans in other branches may be educated rapidly, the infusion of the necessary artistic quality keeps wood carvers comparatively few.

Palaces of Splendor.

In the houses of the rich some examples of the wood carver's art are to be found whose cost is enough to stagger the everyday imagination. A bookcase in the home of a local banker cost $6500. A pair of doors in the residence of a millionaire manufacturer cost $6000; a table, $1000; a sideboard, $1200; a carved mantel, $1750. All these were local Philadelphia products, made by the hands of artisans to whom, by the way, much of the work used in New York and other great cities is also entrusted.

One cannot help wondering what our simple-minded forefathers and mothers, who lived in plain log houses and fought their way in the wilderness, would say if they could now look around upon the luxuries enjoyed by their grandchildren and the evidences of unbounded wealth to be found in all of our large cities.

Our millionaires are buying the best things the markets of the world afford. We have palaces in all the older parts of the land that rival in elegance and beauty the country seats of the nobility of Europe. It may be argued that we are no better or happier for all this. It certainly is true that the sweetest content, according to Robert Burns, was found in the home of the humble cotter.

To race and toil and worry and half kill oneself in the mad effort to be happy, is an idiotic absurdity.

NOTORIOUS FORTUNE TELLER

Story of a Remarkable Woman—Shrewdness and Tact. Her Distinguished Patrons.

ALTHOUGH well advanced in years, Gipsy Lee is as strong and sturdy as many a woman twenty or even thirty years her junior. She is about medium height, with the strongly marked physiognomy peculiar to the gipsy race. Her eyes are still black and gleaming, and her dark skin retains the olive tint which renders the younger women of her tribe so attractive. Her small features and high cheek-bones set her as much apart from the ordinary English woman as the North American Indians, the Chinese, or the natives of Hindustan.

When visited by the writer, she was clad in gorgeous garments and wore seven massive gold rings on her fingers. Bound around her head and fastened beneath her chin was a yellow kerchief, while a bright scarlet cloak enveloped her figure, giving her a somewhat picturesque appearance. Her small but cosy one-roomed house was bright with flowers and dainty colored curtains, pictures adorned the wooden walls, and the illumination was supplied by means of an oil lamp.

One could not be long in Gipsy Lee's company without realizing that she is a woman of great tact and penetration. She reads not only the hand, but the face, as easily as an ordinary person would read the pages of a printed book, and her judgment in regard to both is rapid and decisive. She notes, in addition to the lines on the palm, the shape of the hand and the formation of the fingers, as well as the tips and nails, and nothing seems to be too small to escape her observation.

Before questioning her with reference to the practice of her art, the writer elicited from her some information with reference to her early life and experience. She seems to have possessed the great advantage of having as her mother a clever fortune-teller, who trained her in the art from the time she was a girl. This mother likewise enjoyed the unique distinction of being the seventh daughter of the seventh daughter of a well-known family of the Gipsy Lees.

For a considerable time she assisted her mother in the exercise of her art, after which she traveled through the country and attended horse races for more than forty years. It is, of course, impossible to verify the accuracy of all her claims, for many of her former clients have gone to rest, others not revealing their identity. All, therefore, that the writer can do is to record her statements, merely remarking that some of them confirm the stories that have been coupled with her as an accurate forecaster of future events.

Among the distinguished people whose hands Gipsy Lee has examined was the late Mr. Gladstone, whose great career as a statesman she claims to have foretold. She also stated that she was consulted by the well-known Colonel North, and that she informed him he would be extremely wealthy, but that he would be cut off under circumstances which have since become known to the public.

She added that on the morning of the Derby, of one year, she was visited by Sir Joseph Hawley, who was told by her that he would win the great race and that he would own two Derby winners. For this forecast, which proved to be true, Sir Joseph made her a present of $125. In the following year she was consulted by George Fordham, the well-known jockey, and she told him that he would ride the winners of the Oaks and the Derby.

Later another great jockey, Fred Archer, learned from her that he would ride as many Derby winners or more than any other man. At the same time she advised him to leave off riding when he became heavy, or he would come to an untimely end.

Of the thousands of people that have consulted Gipsy Lee, many of them have come from distant parts of the country. Others have heard of her only from their friends, and, having been unable to secure a personal interview, have sent to her impressions of their hands, for the purpose of having their fortune told.

GIPSY LEE, THE FAMOUS FORTUNE TELLER.

Some of the impressions taken in those circumstances may be seen in the gipsy's house, and the writer naturally questioned her about them.

He was informed that such impressions, when taken carefully on white paper, so as to show all the lines of the hand as well as the shape of the fingers, were very useful, and that a reading could be given by such means with considerable accuracy

Another method by which the future of her clients could be foretold was with the aid of planet cards, and the gipsy stated that if both the hands and the cards were consulted, "everything was told" that the visitor was desirous of knowing.

Evidently Gipsy Lee is a genius in her line, and if she has no power to forecast the future, she has a way of making people believe she can do it.

WONDERFUL LONGEVITY

THOUGH careful investigation has shown that the great majority of supposed centenarians are not such, yet there are some cases of extraordinary longevity—even of men who have lived far beyond one hundred years—which are so well attested that they have gained universal credence. A few of these instances are those of men who have attained not merely to the Scriptural age of threescore and ten, but even to seven and upward of eight scores.

We have all heard of Katherine Fitzgerald, Countess of Desmond,—

"Who lived to the age of one hundred and ten,
And died by a fall from a cherry tree then;"

but the fact appears to be that she lived to the age of one hundred and forty years. Born in Waterford County, Ireland, she is said to have been presented at the court of Edward IV., to have danced with "the crooked-back tyrant," Richard III., and to have lived through five subsequent reigns, and till after the accession of James I., when she died, in 1603.

Thomas Parr, usually known as "Old Parr," who was certainly far above par in vitality, spun out his thread of life to one hundred and fifty-two years. Married at the age of one hundred and twenty, he worked at his calling of tiller of the soil till he was more than ten years older, and fell beneath the scythe of time in 1635. Even then his death was untimely, caused by the mistaken kindness of the Earl of Arundel.

That nobleman brought him to London and presented him to Charles I. as a man who had seen nine kings and queens of England. For a while he was one of the "sights" of London. Becoming one of the Earl's servants, the old man, who had been accustomed all his life before to plain fare, was fed so sumptuously that he died of a surfeit. Parr had such a genius for longevity that it

was believed he might have lived for some years more but for the unlucky change of diet. He was late in venturing upon matrimony, namely, when eighty-eight years old, but found it so blissful that he married again.

Fifty Years' Courtship.

Another old bridegroom was Robert Taylor, who, born in central Ireland in the year 1764, was married in 1872, at the age of one hundred and eight, after a courtship five times as long as the siege of Troy, or fifty years in duration. Taylor, though of small stature, was a great wrestler, and went at one time to Paris "to see Bony" (Bonaparte), whom he found "a little fellow, whom he could easily down." He was postmaster for seventy years, and died in 1898, one hundred and thirty-four years old.

The oldest link with the past of which our country can boast was probably Joseph Crele, born near Detroit, Michigan, in 1725, who died at Caledonia, Wisconsin, on January 27, 1865, at the marvelous age of one hundred and forty years. He was seven years old at the birth of Washington, and fifty at the beginning of the American Revolution, and eighty-four at the birth of Abraham Lincoln.

He had fought, it is said, in Europe under both Marlborough and Napoleon. As Crele's baptism is said to be on record in the French Catholic Church in Detroit, his age seems to be duly authenticated. A Boston clergyman, who once saw this tough specimen of humanity, has described him to us, in exact accordance with our preconceptions of his appearance, as "a little, spare, wizened, dried-up Frenchman."

It seems a little difficult to believe what is, nevertheless, a fact, that the cold, bleak State of Maine has produced the oldest of New England centenarians, namely, John Gilley, of West Augusta, who died in 1842 at the age of one hundred and twenty-four. He married at eighty and had ten children, of whom the youngest at his death was more than one hundred years younger than his father. The veteran's hair was a pure silver white, but shortly before he died it turned black. His teeth were perfect and sound almost to the last. His remarkable longevity attracted many to see him, and among his visitors were Doctor Harris, of Harvard College, and ex-Governor Gore, of Massachusetts.

How to Attain Great Age.

There is another question of common interest: "How shall we live to attain great age? There have been many teachers with many fads; but from the varied modes of life of those who have lived long, it is probable that as no amount of feeding will make a man tall who is destined to be short, so no amount of care will prolong the life of one destined to die young. St. Anthony lives a life of excessive austerity and he dies at 105. Titian is all his life about a court and he paints a fine picture at ninety-six.

Statistics have been accumulated, and such general facts that married people live longer than unmarried, that women live longer than men, and that clergy have longer lives than other professional men, have been established. Many kinds of labor have a tendency to shorten life, yet these are all reckoned in the general average.

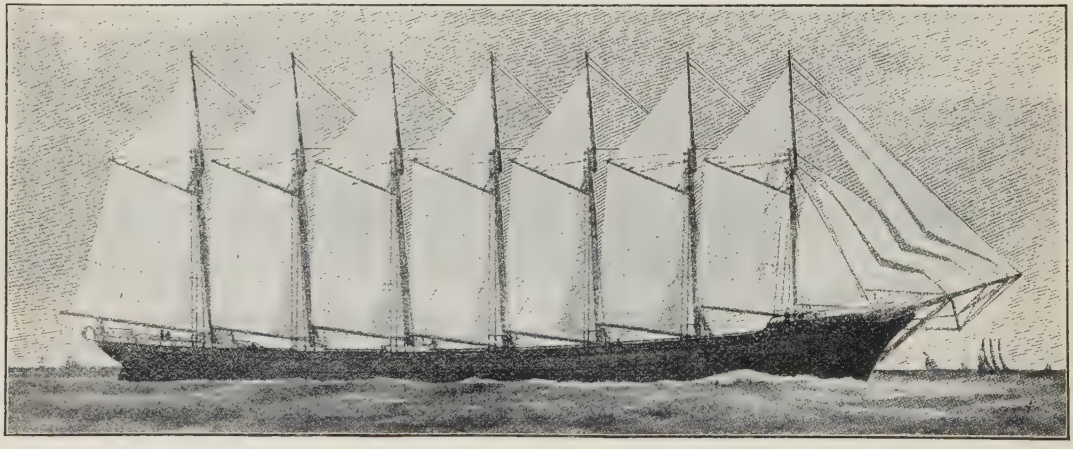
SEVEN-MASTED SCHOONER

Largest Vessel of This Class Afloat—Her Immense Tonnage.

THE great schooner "Thomas W. Lawson," was built at the shipyard of the Fore River Ship and Engine Building Company, of Quincy, Mass. She is the only seven-masted schooner afloat, and one of the largest sailing vessels in the world. She was built for Captain J. G. Crowley, of Taunton, Mass., and designed by Bowdoin B. Crowninshield.

The new vessel is built of steel, each one of the masts, when full rigged, weighing eighteen tons. Her dimensions are: Length over all, 395 feet; length on load water line, 368 feet; beam, 50 feet; depth, 34 feet 5 inches; and draft, 26 feet 6 inches. When loaded her displacement will be 10,000 tons. The masts are named fore, main, mizzen, spanker, jigger, driver and pusher.

The "Lawson" has three complete decks, which are of steel plating, the upper deck, forecastle and poop deck being wood covered. A collision bulk head has been put in at a suitable distance from the stem. Each one of her masts is 135 feet high, from the mast step to the top of the upper band, and they have a uniform diameter throughout of 32 inches. The topmasts are of pine. They are 58 feet in length over all, tapering from 18 inches in diameter to 10 inches, except the foremast, which is 64 feet in length and 20



SEVEN-MASTED SCHOONER, LARGEST EVER BUILT.

inches at its point of greatest diameter. The total sail area of the lower sails and topsails is 40,617 square feet.

Although the "Lawson" receives her motive power entirely from her sails, she carries a considerable instalment of machinery, including one 9-inch by 10-inch ship engine and five 6-inch by 8-inch hoisting engines. There are two vertical boilers, 56 inches in diameter by 90 inches high, one in the forward and one in the afterhouse. Besides these she has pumps and machinery for hoisting purposes. Her crew consists of nineteen men. The total cost of building this vessel was $250,000.

Vastness of Tonnage.

This mammoth schooner will be able to carry 7500 tons of coal, the cargo of six ordinary-sized schooners. As the construction of a vessel of such great size requires a combination of great strength, and not too great weight, the entire craft has been built of steel. Not a bit of wood has been used except for the cabin fittings and for sheathing the upper deck. The platings, beams, stringers and decks are composed entirely of steel, and even the three lower houses on deck are built of metal.

One of our newspaper journals thus comments on this extraordinary craft:

"In the old days when sailing craft transported the commerce of the world American schooners were famous for the speed with which they made voyages and the celerity with which they were handled. Many of the most famous privateers in the war of 1812 were swift little vessels of this sort, and for years after that this particular type was esteemed peculiarly American.

"A schooner of a far different kind is the mammoth seven-masted freight carrier which was launched at Quincy, Mass. With an array of spars which would have filled the captains of former days with astonishment, the 'Thomas W. Lawson' is practically several schooners in one. That very big sailing ships can be utilized profitably in the transportation of cargoes where high speed is not a requisite has long been known. It has remained for American architects in the past few years to demonstrate that the schooner rig, with its lessening of the number of men required to handle it, is preferable even in heavy-weight vessels to the equipment of a full-rigged ship.

For Coasting Trade.

"This development promises to be of importance in the coasting trade of the United States. It is much cheaper to operate one big vessel than half a dozen little ones, whose total cargo capacity is no greater than that of their single competitor. The assumption that steam is certain to drive sails off the ocean has been frequently put forward, but it is by no means certain that it is correct. There must always remain a large class of merchandise which does not mean to be taken from point to point with great speed, and in carrying such goods the economically-managed sailing vessel has a distinct advantage.

"This applies especially to the coastwise commerce of the United States, whose extent few Americans appreciate. The tonnage of the vessels engaged in this amounts to about 5,000,000, and their total number, including the humble barge and canal boats, is over 21,000, while the

value of the products they take from port to port yearly reaches enormous proportions. This is a fact which affords some compensation for the comparatively stagnant condition of the country's deep-sea mercantile marine."

GIGANTIC SPIRAL QUARTZ COLUMNS

THE mystery of the Devil's Corkscrew is solved at last. And the explanation is almost as wonderful as was the puzzle.

For some time past scientific attention has been bent upon certain extraordinary freaks of nature in the Bad Lands of Nebraska. They are corkscrew-shaped columns of quartz, often fifteen or twenty feet in height. These are found in great numbers embedded in the sandstone hills of that region. Always standing perfectly vertical, and so absolutely symmetrical as to challenge comparison for accuracy of design with any work of the sculptor's art, they are numbered literally by millions, being "weathered out" singly and in rows from the sides of the cliffs.

Obviously, they cannot be works of art, but, on the other hand, they bear no likeness to anything in nature. If they are fossils, what could they have been before they became fossilized? Somebody suggested that they were "fossil gopher holes," which had been filled with quartz material in a bygone age; but the notion was obviously absurd, especially in view of the fact that gophers do not dig their burrows in mathematically symmetrical spirals.

For lack of a better name, the spiral columns came to be known as devil's corkscrews—a term which science has accepted, designating the phenomenon as the "daemonelix," which means exactly the same thing. The more dignified title was bestowed by Prof. E. H. Barbour, of the University of Nebraska, who headed an exploring expedition sent out to the Bad Lands by that educational institution for no other purpose than to find a solution for the strange problem.

A good many of the corkscrews were quarried out of the sandstone rock by the Barbour party, and a notable part of their structure in each case was found to be a huge "root" (if such it might be termed) attached to the lower end. The root was sometimes as big around as a hogshead, and in a large specimen with a spiral of say fifteen feet, the root would be as much as twenty feet long. This was claimed by advocates of the gopher theory to represent the nest of the gigantic rodent, the screw being, of course, the burrow communicating with the surface of the ground.

When, on one occasion, the bones of a gopher were actually found embedded in the quartz of a corkscrew, the gopher advocates were convinced that their theory had been proven; but later some bones of a deer were discovered in the substance of another spiral, and it was the turn of the anti-gopherites to laugh. A notable point about the screws, by the way, is that some of them turn to the right and others to the left—unlike the ordinary corkscrew used for opening bottles—while now and then a specimen is dug out that winds gracefully about a vertical axis like a vine around a stick.

Their Organic Origin.

After a thorough exploration of the daemonelix "beds," and after carefully quarrying out several hundred specimens, Professor Barbour decided that the corkscrews were unquestionably of organic origin—that is, animal or vegetable—inasmuch as their symmetrical form could be accounted for in no other way. They were assuredly not animals, and so must have been plants. If so, what kind of plants? The answer to this question was only to be obtained by reviewing the geological history of the region.

Now, it appears that all that part of the country was covered a million years ago by an immense lake, which occupied the whole of the vast basin of the Rocky Mountains. It was an inland sea of fresh water, on the bottom of which grew the most wonderful water-weeds that ever existed. Some of them were twenty feet or more in height, and they assumed the form of large spirals, mathematically exact in curvature. Quite possibly each spiral was composed of a group of plants, forming a sort of community, but this is uncertain.

Anyway, in the course of ages, vast quantities of mud were poured by the rivers into the lake, and thus the water-weeds became buried—whole fields of them together. Time went by—long aeons of time, in fact—and the lake dried up, its bottom becoming dry land. Incidentally, the plants decaying were replaced, particle by particle, by silica from water which contained it. Silica, of course, is the material of quartz, and thus it is that the so-called Devil's Corkscrews were formed, reproducing in rocky substance the vegetables from which they originated.

A Mystery No Longer.

So the Devil's Corkscrew is no longer a mystery, though the discovery of its true nature has involved the solving of one of the most interesting puzzles ever tackled by the scientific investigator.

As far as has yet been determined from the rocky tablets of the earth's crust, ferns first appeared in the Devonian period, and these comprised both herbaceous and arborescent species. In the immediately succeeding coal period they appear to have reached their maximum development. The dense forests and the moist atmospheres of this period were so suited to their growth that they formed a large bulk of the vegetation. Several hundred species have been described, some of them tree ferns of a size fitting them to be the companions of the immense Sigillarias and Lepidodendrons, whose remains are found associated with theirs in the carboniferous rocks. Thus organic and chemical changes are constantly taking place under ground.

Famous Club of Athletes

IN 1778 there was born in Wurtemberg, Germany, Frederick Ludwig Jahn, who was the father of the modern form of gymnastics. In his youth his parents had it mapped out that he should become a teacher, and eventually their plans were fulfilled.

ATHLETIC FIELD EXERCISES OF THE SOCIETY KNOWN AS THE TURNERS.

While teaching at a school in Berlin, about the year 1810, he took his children out to the suburbs and there had them exercise according to his methods. Presently the value of such exercises became known, and little by little people followed his ideas, and in a comparatively short time Turn Vereins, or athletic clubs, were organized all over the German Empire.

The members banded together similar to an organized order or lodge, and as they became so numerous and their exercises were so much like a military affair, the government became scared

and Jahn was imprisoned for two years, because, it was said, his motto "Frisch, Froelich, Frei," (Healthy, Happy, Free,) was a menace to the safety of the government.

However, this sentiment soon died out and the followers of Jahn, after his incarceration made still greater progress. Jahn died in 1852 at Freiburg. Up until 1845 turning, as it is called, was little known outside of Germany itself. When the revolution broke out in 1844, and the refugees fled to America the German Turn Vereins were started in this country. Wherever a German community was located there was sure to be a turn verein, and in a few years all the clubs or vereins in the eastern part of the United States banded together and formed a national body.

Every year there was to be a national turnfest or turn-festival, held in one city, then another, and, of course, the features would be the contests of various sorts between its members of the national league. Prizes were distributed for all branches of athletics, including swimming, fencing, wrestling, jumping, running, climbing and the exercises on the bars, horizontal and others.

In later years as the members increased these fests or festivals increased in magnitude and it was common to see five or six thousand men exercise in a field. The picture shown in this article gives a small idea of how formidable and tremendous such an athletic function really is.

In Cincinnati, Ohio, several years ago, a large turnfest was held and about six thousand men, young and middle-aged, formed on a large field and gave an exhibition of the body movement. The body is bent from side to side, the arms at times extended, and again they are held to the side. To see this army of muscular, healthy men bending and straightening in unison was a wonderful sight, and never can be forgotten by those who had the good fortune to witness it. Turning, or athletics, has taken a general hold on the American public, and it is gradually being introduced in the city schools and academies, and especially in the universities.

WONDERS OF COLORADO

THE great State of Colorado is famous for its canyons, through the most of which flow underground rivers, and for its curious rock formations. These render the natural scenery peculiar, while the visitor is impressed with the grandeur of the scene.

Not quite one-half of this region was acquired by the United States from France in the Louisiana purchase of 1804; the remainder was ceded by Mexico under the treaty of 1848, together with California and New Mexico, of which last is formed a portion. The southern part of Colorado has for many years had a small Spanish-speaking population, partially of Indian

descent. Colorado was organized as a territory in 1861, and was admitted as a state in 1876.

The population is of mixed origin, but is largely derived from older states of the Union. The distinctly American traits of enterprise and progress, shown alike in business methods and in measures for the spread of popular education, are nowhere more conspicuous than here. The principal towns are Denver, the capital, Leadville, in the carbonate-mining district of the Rocky mountain (10,200 feet above sea-level), and Pueblo; and there are a number of minor towns of considerable importance, most of them mining centres.

We present the reader with a striking photograph of singular rock formations in Colorado, known as the "Toad" and "Toadstools." They bear a strong resemblance to the vegetable product and the reptile which have these names.

Remarkable rock formations that resemble different objects are often observed. For instance, a near approach to Mount Washington can be made by railway, and in addition to this a carriage road on the east side enables the traveler to reach the highest point. Here may be seen other peaks far below, gulches through which dashing streams flow. Among other objects of interest is the "Old Man of the Mountain," in the Franconia group, opposite Mount Lafayette. It is a remarkable profile of a human face, eighty feet in length and formed by the singular grouping of three immense, projecting rocks.

ROCKS IN THE FORM OF TOAD AND TOADSTOOLS, MONUMENT PARK, COLORADO.

RESTAURANT WITHOUT WAITERS

Electric Trolleys Serve All the Orders Quickly and in Silence. Power of Niagara Supplies the Current That Operates Everything in This Unique Institution.

AN electric restaurant is the latest development of man's ingenuity. At Niagara Falls such an institution has been started and it is running successfully.

No waiters, no loud calling of orders, no confusion, and, above all, no long waits between courses. These are some of the advantages of the new system of things. Meals are ordered, cooked and served by the power of the great cataract that rushes along beneath the windows of the unique institution.

The restaurant is located in a ten-story structure, occupied by a natural food company. It stands on the high bank of the Niagara river, a few hundred feet above the mighty falls. When the wind is from the north the spray enclouds the entire building, and the diners, looking from the windows through this sun-tinted mist, may see the foaming, roaring rapids as the water surges along just before taking the plunge.

The restaurant has been constructed at a cost of $50,000, and is conducted for the benefit of visitors to the falls and the employes of the company.

Below, through a canal that darts in from the river, runs the water used for the entire industry. In the manufacturing department hundreds of employes rush about taking the food product from huge ferris-wheel ovens that are heated by electricity, carried from floor to floor on electric elevators, and from there to the shipping department on electric motor trains.

Walking into the dining rooms, the visitor finds 500 small tables. Each is equipped with an electric car, a menu card, a small desk and a revolving chair. There is a pad for the order lying on the desk. When this has been filled out it is placed on the car. Then an electric button buried in the side of the desk is pressed. Slowly the car moves out from the switch, starting as if by magic directly after the push-button signal is given.

The car gains speed as it reaches the main track and then dashes away, banging over switches until it is lost from view in the rapidly moving mass of a hundred cars going or coming from the kitchen.

As the tracks diverge from the main line on to the kitchen switch the current

is broken and they slow up, coming to a stop near the ovens. This contrivance does its work admirably.

When the car arrives at its destination a small, bright-red light flashes up on the anxious diner's desk announcing that his order has been received and is being filled. As this light disappears the car starts out from the kitchen on the return journey. Coming back it may pass ten, twenty or two hundred switches, but not until it has reached its starting point does it leave the main track; then—still at lightning speed—it darts in, striking an air-filled bulkhead that greatly diminishes the speed, until it brings the car to a stop, without spilling even a drop of tea.

Everything in this magical restaurant is produced by means of electric currents generated with power taken from the river. Steaks are broiled over an electric blaze, and ovens are heated by this marvelous current. Electricity boils the water and singes the pin feathers of the birds, and at the same time it operates the ice machine that keeps the small bottles cool.

Run by Electricity.

A youthful expert at the switchboard runs the entire system. Sometimes he has more than 100 cars in motion. The switchboard, after once starting the cars, has but little to do in conducting the trip, for no railroad in the country has a more thorough block system. If by any accident a car should become disabled or leave the rails, the next approaching car short-circuits the current in that block and brings all the little vehicles within the danger line to a stop. They remain stationary until the "wreckers" can arrive to repair the damage.

By means of a mechanical arrangement on the bottom of every car each throws its own switch. As it leaves for the kitchen it throws the rails so as to leave the track clear, and returning, opens them again, and thus makes its own siding without the assistance from the switchboard.

Deep Wheelpits.

As this water that furnishes the power flows down there is a difference of about 200 feet in its level one and a quarter miles above and its surface just below the falls. On the American shore of the upper level are situated the two wheelpits and power houses of the Niagara Falls Power Company. Each of the wheelpits is about 180 feet in depth, 20 feet wide and 463 feet long, and excavated through solid rock.

Both discharge to the lower level of the river at a point a few hundred feet below the falls, through the same 21-foot tunnel, one and one-third miles in length and extending under the city at a depth of about 200 feet.

Through this tunnel the water rushes to the power house, where it generates the electricity. Hundreds of thousands of gallons a minute pour into the cylinder chambers and dash on again to the river through the outlet canal. The cylinders are located 250 feet below the surface, and over the mighty vortex are seen men with lanterns, dressed in rubber coats, always watching for driftwood or other flotsam that may have found their way into the channel and would interfere with the machinery.

PETROLEUM INDUSTRY OF THE UNITED STATES

How Oil Wells are Bored—Fabulous Fortunes Made—New Discoveries of Petroleum in Many Places.

RICHER than the gold mines of California in the qualities of usefulness and convenience to the human race, are the oil wells which, so unexpectedly to the country and the world, spouted forth their liquid treasures from the bowels of the earth, in the year 1859, and in such quantities as soon to revolutionize both the material and mode of artificial illumination—bringing untold wealth into regions hitherto comparatively valueless—creating, almost as if by magic, new, vast and profitable industries, well-nigh realizing the wildest conceptions of sudden and golden fortune found in Arabian legends.

But even long prior to the year just named, the existence of this oleaginous substance was known at the head-waters of the Alleghany river in New York and Pennsylvania. A writer in the American Cyclopedia states that the Indians collected it on the shores of Seneca lake, and it was sold as a medicine by the name of Seneca or Genesee oil. A stream in Allegany county, New York, was named Oil Creek, in consequence of the appearance of oil in its banks; and the same name was given to another branch of the Alleghany river in Venango county, Pennsylvania.

Several localities are designated upon the old maps of this part of the country as affording oil; and upon Oil Creek, in Venango county, two spots were particularly noted, one of which was close to the north line of the county and one about twelve miles further down the stream. At these points springs issued from the banks of the stream, bringing up more or less oil, which collected upon the surface of the water as it stood in the pools below the springs. The inhabitants were accustomed to collect the oil by spreading woolen cloths upon the water, and wringing them when saturated.

Down the valley of this creek there are numerous ancient pits which appear to have been excavated for the purpose of collecting oil, but by whom made no one can now tell. From the fact that logs have been found in them notched as if

with an axe, some have supposed that the work was done by the French, who occupied this region in the early part of the last century; but others believe that the Indians, who are known to have valued the oil, dug the pits.

Used for Anointing.

Day, in his history of Pennsylvania, gives an account of the estimation in which they held this product, using it mixed with paint to anoint themselves for war, and also employing it in their religious rites. He quotes an interesting letter from the commander of Fort Duquesne to General Montcalm, describing an assembly of the Indians by night on the banks of the creek, and in the midst of the ceremonies their firing the scum of oil that had collected upon the surface of the water. As the flames burst forth, illuminating the dark valley, there rose from the Indians around triumphant shouts that made the hills re-echo again.

As early as 1826, the knowledge that such a natural illuminating substance existed on the Little Muskingum river, in Ohio, was quite general, on account of its appearance in the wells that were bored in that region for the purpose of obtaining salt.

In a communication to the American Journal of Science for the year 1826, by Doctor Hildreth, he says: "They have sunk two wells, which are now more than four hundred feet in depth; one of them affords a very strong and pure water, but not in great quantity. The other discharges such vast quantities of petroleum, or, as it is vulgarly called, 'Seneka oil,' and besides is subject to such tremendous explosions of gas as to force out all the water and afford nothing but gas for several days that they make but little or no salt. Nevertheless the petroleum affords considerable profit and is beginning to be in demand for lamps in workshops and manufactories. It affords a brisk, clear light when burnt in this way, and will be a valuable article for lighting the street lamps in the future cities of Ohio."

So useful was the product of the oil springs gradually found to be, that, in 1854, the Pennsylvania Rock Oil Company was formed. It is said by a writer thoroughly conversant with the subject and from whose well-stored pamphlet, "The Petroleum Region of America," much of the information here given is drawn, that this was the first oil company ever formed, and was also prior to the sinking of any well, and before any such thing was suggested.

How it Was Collected.

Great quantities of the oil had, however, been collected during the year 1853 by absorbing it in blankets and wringing it out, a method originated by Dr. F. B. Brewer, of the eminent firm of Brewer, Watson & Co., so conspicuous in their efforts to develop the wonderful resources of the oil region. The Pennsylvania Rock Oil Company purchased one hundred acres of land on Oil Creek, below Titusville, for the purpose of collecting the surface oil, but the project was in a short time abandoned.

No important progress took place in the business until the winter of 1857, when Col. E. L. Drake, of Connecticut, arrived at Titusville, and he was the first man who attempted to bore for oil. In December, 1857, he visited Titusville, examined the

oil springs, and gave the subject of surface oil a thorough investigation. He soon concluded that rock oil could be obtained by sinking a well, and acting upon this, he, in company with James M. Townsend and E. B. Bowditch, leased the lands of the Pennsylvania Rock Oil Company for the term of twenty-five years for the purpose of boring for oil. The operations were to commence the following spring. Soon after closing this lease Colonel Drake and friends from Connecticut formed a company called the Seneca Oil Company for the purpose of working the lands and sinking wells under the management and control of Colonel Drake.

Began Boring.

Early in the spring he removed his family to Titusville, then containing not over one hundred and fifty inhabitants. He first informed himself thoroughly on the subject of boring and visited the salt wells on the Alleghany river for that purpose, where, after some difficulty, he employed a man who agreed to sink wells for the Seneca Company; but he and others to whom he had applied failed to keep their engagements, and it was not until the following spring that he could obtain a suitable person to commence the well.

Boring through forty-seven feet of gravel and twenty-two feet of shale rocks, with occasional small apertures in it, he struck on the 29th of August, 1859, at the depth of about seventy feet a large opening filled with coal oil, somewhat mixed with water and gas. A small pump on hand brought up from four hundred to five hundred gallons of oil a day. An explosion soon blew it up.

One of three times its size and power was put in its place, and during the first four days threw up five thousand gallons of oil, one thousand two hundred and fifty gallons per day, or one gallon per minute for twenty hours fifty minutes per day, which was a remarkable yield.

Intense Excitement.

And now commenced an intense excitement in all the oil region of Pennsylvania, lying along the valley of Oil Creek and its tributaries in Venango, Warren and Crawford counties. The Drake well—the first ever sunk for oil, and the first petroleum ever obtained by boring—was immediately thronged with visitors, and within two or three weeks thousands began to pour in from the neighboring States.

Everybody was eager to purchase or lease oil lands at any price demanded. Almost in a night, a wilderness of derricks sprang up and covered the entire bottom lands of Oil Creek. Merchants abandoned their storehouses, farmers dropped their ploughs, lawyers deserted their offices and preachers their pulpits. The entire western part of the State, in especial, became so wild with excitement upon the subject, that scarcely anything else was thought of.

Very soon after the success of Colonel Drake, Messrs. Brewer, Watson & Co. leased the farm of Hamilton M'Clintock, and commenced a well on it, which was successful at the depth of seventy feet; then followed the sinking of many wells on the different farms of Oil Creek. The Barnsdell, Mead and Rouse well was opened in the spring of 1860; then the Crosley well, in April of the same year. During this summer, many wells were

opened in the vicinity of Tideoute on the Alleghany river.

In June, 1861, A. B. Funk sunk a well four hundred and seventy feet deep, on the M'Illheny farm, which was the first large flowing well. Then followed the Brewer, Watson & Co. well on the G. W. M'Clintock farm, the Phillips well on the Tarr farm, the Willard well on the H. M'Clintock farm and the Rouse, Mitchell, and Brown well on the Buchanan farm. This latter well flowed a stream of oil without pumping, equal to one thousand barrels per day.

New Discoveries.

In every direction, new borings were undertaken and new discoveries of flowing wells were made almost daily, while other regions of similar geological structure were carefully explored for evidence of their capacity for producing oil. Soon there were oil wells—either pumping or flowing—yielding considerable quantities in Western Virginia, Kentucky, Ohio and Canada; and, subsequently, discoveries were made of the existence of petroleum in large quantities in California and in some of the Northwestern States.

At first, vast quantities of oil flowed into the creek and were wasted, before suitable tanks could be prepared to receive it; the flowing wells were fitted with strong tubing and stop-cocks, by means of which the supply was entirely controlled.

As might well be expected, the owners of farms in the oil regions believed that the fortune of almost unlimited wealth had now smiled upon them, and (says Eaton, in his exhaustive and invaluable work on the subject,) the price of lands throughout its whole extent, from the new well to the Alleghany, immediately rose to a very high figure. Sometimes entire farms were sold, but generally they were leased n quite small lots. The terms of lease were at first easy, the operators giving one-fourth or one-fifth of the oil as a royalty to the owner of the soil.

Owners Getting Rich.

Gradually, the terms became more exacting, until not infrequently one-half and even five-eighths of the oil was demanded, with the addition of a considerable sum of money as a bonus. Sometimes the proprietor of the soil required the proposed operator to furnish him his share in barrels; that is, not only turning him over a third or a half of the oil, but furnishing him the barrels to contain it. With this arrangement, it afterwards came about that, as the price of oil fell and the price of barrels advanced, the entire proceeds of some wells would hardly purchase barrels to contain the royalty share pertaining to the owner of the land.

The leasing of land for oil purposes amounted, at one time, to a monopoly in some sections of the oil valley. The landholders in many places were men in very moderate circumstances. By great frugality they had been able to live comfortably, but had no extra means with which to embark in speculations. Sometimes they had neither taste nor energy for this business or lacked faith in the general result, but were willing that others should embark in the business by sharing the profits with them. In this state of affairs, shrewd and enterprising men made a business, for a time, of leasing all the lands in certain localities, with no inten-

tion of operating themselves, but with the design of sub-leasing to real operators.

In the midst of the excitement occasioned by the prodigious success of the Rouse well, the gas and oil issuing therefrom took fire from some unknown cause, and, as described by an unknown witness, columns of black smoke rolled upward into the air the blazing oil leaped heavenward, and, falling over on all sides from the fiery jet, formed a magnificent fountain of liquid fire.

Death in the Flames.

The sight was awfully grand, but, sad to relate, involved a most melancholy loss of life, no less than nineteen human beings meeting their death in the flames. The scenes of terror and woe accompanying such a catastrophe can be better imagined than described. Among the victims of this destructive occurrence was Mr. Rouse, one of the proprietors of the well and a very prominent man in the oil region.

Mr. Rouse lived for several days after being injured, and, in framing his will, after making certain bequests, left to the county of Warren a handsome sum—subsequently reaching one hundred and fifty thousand dollars in value—to be applied one-half for road purposes and one-half to the poor of the county.

Other terrible scenes caused by the combustion of the oil and gas in the wells—of natural or accidental origin—though happily not involving loss of life, have occurred from time to time in the oil regions. The phenomenon of the "burning well" has been often described as one of those grand and amazing exhibitions to be found only within the arena of nature's kingdom. Before approaching near enough to see the well (says an eye witness), the observer's ears were saluted with a roaring sound similar to that of the Geysers in Iceland, and seemingly due to the rush of gas from the depths below, or from the flame itself as it rises high in the air.

The well was, of course, bored for oil. It had reached a depth of some five hundred feet, when the immense column of gas rushed up and became ignited from the furnace of the engine. Soon, of course, the derrick, engine-house, and fixtures were consumed, and the engine itself a wreck. An attempt was made to fill up the pit with earth and extinguish the flames. But this proved a failure, as the pressure of the gas was so great that it rushed through the loose earth in a thousand jets, the result being that a column of flames constantly emerged from the pit equal to its size—about eight feet square; this column rose to a height of from fifty to one hundred feet, varying every few seconds from the minimum to the maximum height.

Awfully Grand.

The pillar, rough and jagged in form, and sometimes divided, sent out its tongues of flame in every direction. As it reached its greatest height, the top of the flame leaped off and was extinguished. This was the appearance in daylight. At night, the appearance was awfully grand and imposing. Every three or four seconds a cloud of dark smoke rolled up with the flames, and, after being swept to its very summit, disappeared. Some visitors computed the height at one hundred and fifty feet. The roaring sound was constant, and almost resembled that

of distant thunder. For successive weeks the well continued to burn, with no apparent diminution in its power or in the quantity of gas.

Strange Appearance.

At one time the phenomenon assumed a very strange appearance. The atmosphere was somewhat cloudy, and, in addition to the usual ruddy glow, the light appeared to concentrate itself into a bright lance-like figure, about four or five degrees in length, that remained stationary about midway between the horizon and the zenith, where it continued all the evening. Immense destruction of oil and other property by fire has, in fact, taken place in almost every part of the petroleum region from the very first, and in spite of every precaution.

The next large flowing well that was opened was the Empire, in the vicinity of the Funk well, that flowed three thousand barrels of oil per day. The Sherman well was opened in April, 1862, then the Noble and Delameter well in May, 1863. This celebrated well was commenced in 1860, and was bored to the depth of one hundred and sixty-seven feet, and then abandoned. Mr. Noble went further down the creek and became interested in other wells on the Tarr farm, but in the spring of 1863 he recommenced the work on his old well, and went down to the depth of four hundred and seventy-one feet, without, however, any indications of oil.

At that depth he concluded to tube and pump, abandoning the idea of obtaining a flowing well; but, to the great astonishment of himself and every one else, after pumping a very short time, suddenly the great Noble well commenced to flow. Long before the opening of this well, petroleum had become so plenty that most of the pumping wells were abandoned. Every person wanted a flowing well.

The discovery of a method of refining the crude oil is said to be due to Mr. Samuel M. Kier, of Pittsburg. Mr. W. H. Abbott, of Titusville, erected the first large refinery at Titusville, which was before the days of railroads in that region. The heavy iron castings and machinery were brought in wagons from Union Mills and Franklin, through mud that was axle-deep. Parties interested with him became disheartened, and would have abandoned the enterprise had it not been for the energy of Mr. Abbott, who finally succeeded in completing his building.

A Fortune in Barrels.

But the really great pioneers in the introduction of petroleum in large quantities were Brewer, Watson & Co., whose enterprise was so determined and untiring that they expended nearly eight hundred thousand dollars in cash for barrels alone before they realized one cent of profit. All they required was the actual cost of the barrel. They, however, ultimately reaped a rich harvest from their arduous efforts in this new field of business, and were handsomely repaid for the hardships and trials through which they had passed.

During the summer of 1861 Samuel Downer, of Boston, established a branch of his works and commenced the refining of oil at Corry, giving his entire attention to the business, and during that year his refinery absorbed nearly all the oil product. George M. Mowbray, agent for

Scheiffln & Co., of New York, made the first extensive purchase of petroleum for shipment. Messrs. Drake, Watson, Brewer, Kier, Abbott, Mowbray, Downer, the firm of Brewer, Watson & Co., and others exerted their utmost endeavors to acquaint the public with the value of the article and to create a demand equal to the supply, but before this could be accomplished oil at the wells was offered for sale at prices ranging from ten to fifty cents a barrel.

Bursting of the Bubble.

In consequence of the abundant supply of the oil, its cheapness and the continued small demand, the entire oil regions of Pennsylvania, Virginia and Ohio became for a while almost wholly deserted, and the then so called "oil bubble" exploded. Most of those who had taken leases and had opened wells now removed the tubing, sold their engines, tools, etc., and retired from the oil trade disgusted with their enterprise, and, no doubt, much displeased with themselves, returned to their deserted homes to be ridiculed by the knowing ones, "who always said the undertaking would prove a failure."

Much time, however, did not elapse before a new demand for petroleum was created, and once more thousands poured into the oil regions, and ultimately the use of petroleum became almost universal as a cheap and excellent oil for burning. So vast did the business now become that from the 3rd of March, 1865, to the close of that year the quantity of crude petroleum produced in the Venango county region was 1,020,126 barrels; in Western Virginia, 13,666; in Ohio, 10,676; in Kentucky, 2405. The trade involved in this immense production became the most important business of several cities in Pennsylvania, Ohio and New York, affording employment and support for tens of thousands of people.

Great Export Trade.

An immense export trade soon began, amounting, in 1863, to 252,000 tons weight, or 28,000,000 gallons, valued at $12,000,000, and employing no less than 252 vessels of one thousand tons burden. Of course, many hitherto comparatively poor persons became millionaires all of a sudden, and of these "some were wise and some were foolish" in the use of their wealth.

An illustration of the latter class was that of a widow whose farm proved to be one of the earliest and best for the production of oil in the whole county of Venango, several wells with products ranging from two hundred to twenty-five hundred barrels per day being struck at intervals and the income in money from the territory proving almost fabulous in amount.

The old lady did not live long to enjoy her good fortune, and dying left her great property, without any reservation, to her adopted son John, then about twenty years old. This youth, like the hero of that well-known novel, "Half a Million of Money," who came suddenly into possession of a like sum, had not been taught to understand the value of dollars and cents, and, unlike that character, he had no refined tastes, and threw his wealth away with the most lavish folly. Of course, he rushed to New York; and there, in only a year and a half, he squandered two millions of dollars.

Presumably the most ingenious extrava-

gance was necessary to accomplish this enormous result. "Johnny," as his associates called him, not only entered into every species of debauchery, not only lost a hundred thousand dollars in two nights at faro, but bought superb teams and gave them away after an hour's ownership, supported a swarm of human leeches of both sexes, and even equipped a negro minstrel troupe, presenting each member with a costly diamond ring and pin.

"Coal Oil Johnny."

By-and-by, however, Johnny's brilliant career came to a close, and, oddly enough, he was glad at last to fill the position of doorkeeper to the traveling minstrel company which his own munificence had organized—his farm on Oil Creek having been disposed of at public sale, for arrears due the government.

Time and space would indeed fail to adequately record the doings of those sham and reckless companies, which, availing themselves of the oleaginous fever and a credulous public, involved themselves and others in operations well-nigh ruinous. One of these companies selected a site in the woods, which had been "prospected" by one of their number and highly recommended (located about six miles from a railroad station laid down on the map, but not yet built), and having organized, agreed to have the first of a series of proposed wells dug, not by contract, as was usual, but by day's work.

Having procured the necessary tools, including a compass for guidance in the woods, the work was duly proceeded with, and progress from time to time reported. Calls for the "sinews" were also made and promptly met, until the well was said to be down over 100 feet, with a good show for oil. This was about the time for the "Annual Meeting," and more money being called for, it was deemed advisable to have the well remeasured and reported on. Judge of the surprise of the stockholders when, to use the language of one of the patriarchs in oil, the force of the oil from below had shoved the hole up to eighty-six feet!

Here was a stunner; and, as the well had already cost a good round sum, and the resources of the company were limited, matters continued to remain *in statu quo*. The most plausible plan for getting out of the difficulty was that which proposed to have the balance of the hole taken up and cut into lengths for pump logs!—a fair hit at many of the chimerical oil projects of that day.

Its Origin.

Various opinions are entertained as to the origin and source of this remarkable substance. According to Professor Silliman, it is of vegetable origin, and was produced by the agency of subterranean heat. Professor Dana says that it is a bituminous liquid resulting from the decomposition of marine or land plants, mainly the latter, and perhaps, also, of some non-nitrogenous animal tissues. By many it is supposed to be a product of coal; some supposing that the coal, being subjected to the enormous pressure of the overlying beds, has yielded oil, as a linseed cake under an hydraulic press.

The theory has even been advanced that the coal, heated (as it evidently has been in the coal regions of eastern Pennsylvania), gave off oily vapors which,

rising to the cold region of the upper air condensed, and subsequently fell in oily showers, making its way as best it could to the hollows of the earth's interior, where now it is found by the oil borer.

Made From Marine Plants.

An extensive survey and examination of the coal region by Mr. Ridgeway, an eminent geologist, convinced him that the petroleum was not produced from the coal fields, as in that case it would have had to flow up hill into the oil basin; it is, rather, the result of the decomposition of marine plants, in the Oil Creek valley, though that found in bituminous coal basins, originates, no doubt, from beds of coal.

According to this theory, the plants which produce the oil in the rock existed and flourished at a long period of time before the vegetation which now forms coal beds; they are unlike the vegetable impressions found in the accompanying shales and clays associated with beds of coal, and they grew where the flagstones and shales of Oil Creek were laid down by salt water currents.

The climate was so hot during this age of marine vegetation, and the growth of plants so rapid and rank, caused by the supposed large amount of carbonic acid and hydrogen then composing the atmosphere, that these conditions on the face of the earth produced plants containing more hydrogen and less carbon than the plants which produced coal beds, and hence their fermentation resulted in petroleum.

But the theory that the oil was produced at the time of the original bituminization of the animal or vegetable matter, has many difficulties in its way, especially the fact that such large quantities of inflammable gas always accompany the oil. That the oil is a product, not of coal, but of coral, is the opinion of some; and thus, stored away in cells, forming, in the aggregate, immense reefs, as it was collected from the impure waters of the early oceans by minute coral insects, it has been driven by heat and pressure into reservoirs and crevices, where man's ingenuity at last discovered it.

For Lighting Purposes.

Of the uses of petroleum much might be said. Unrivaled and universal for illumination, it is also valuable as a lubricator, and, in some of its chemically prepared states, is employed as a dryer in paints and varnishes. For fuel and gas its utility has been amply proved. Medically, it has been found efficacious in suppurating wounds, also in headache, toothache, swellings, rheumatism, dislocations and as a disinfectant. And even as a base in the production of colors, some of the most gratifying results have followed the chemist's experiments with this wonderful article.

The latest discoveries of oil in Texas read almost like a fabulous tale. The interest in these new wells and their vast productions is nearly as great as when oil was first discovered in Pennsylvania.

It is safe to predict that in many other parts of the country oil will be found, and that this important source of wealth will long continue.

And the uses to which it can be applied are likely to increase in number. Already it is used for fuel on some railroads.

ANCIENT MODES OF TRAVEL

ONE of the accompanying illustrations affords a fine representation of the old time English stage coach, which was the forerunner of the stage coaches in the United States. These were much more common in our country before the marvelous extension of the railroads than at the present time.

Yet even now, in many outlying districts, especially in the far West, the four-horse coach is a common object of interest. In connection with its necessary use in the Rocky Mountain region, we read thrilling tales of the manner in which outlaws and cut-throats hold up the travelers and relieve them of their valuables.

COACHING IN THE OLDEN TIME.

But the old stage coach is doomed to disappear. The new railroads in remote districts crowd out the clumsy old vehicles by a quicker, more rapid

mode of conveyance. The improvement in the railroad system is well shown by comparing the first English railway train, seen in the picture, and one of our fast express trains that can make the distance of ninety miles between New York and Philadelphia in eighty minutes, or the lightning express that covers the ground between New York and Chicago in twenty hours.

The evolution of railways forms an interesting study. It is a type of the rapid progress that has been made along all the lines of scientific achievement. Nearly two centuries ago, railways were employed in the Newcastle collieries. Lord Keeper North, in 1676, writes: "The manner of the carriage is by laying rails of timber from the colliery to the river, exactly straight and parallel; and bulky carts are made with four rollers fitting these rails, whereby the carriage is so easy that one horse will draw four or five chaldrons of coals, and is an immense benefit to the coal merchants."

FIRST ENGLISH RAILWAY TRAIN.

Cast-iron rails date a century later, for George Stephenson tells us, from the books of the Coalbrook-Dale Iron Company, that, in 1767, between five and six tons of cast-iron rails were made at these works, but only "as an experiment, on the suggestion of one of the partners." The use of cast-iron rails is stated by Mr. Carr to have been first introduced at the colliery of the Duke of Norfolk, near Sheffield, in 1776. From iron we have gone to steel, and the advantage is worth ten times the cost.

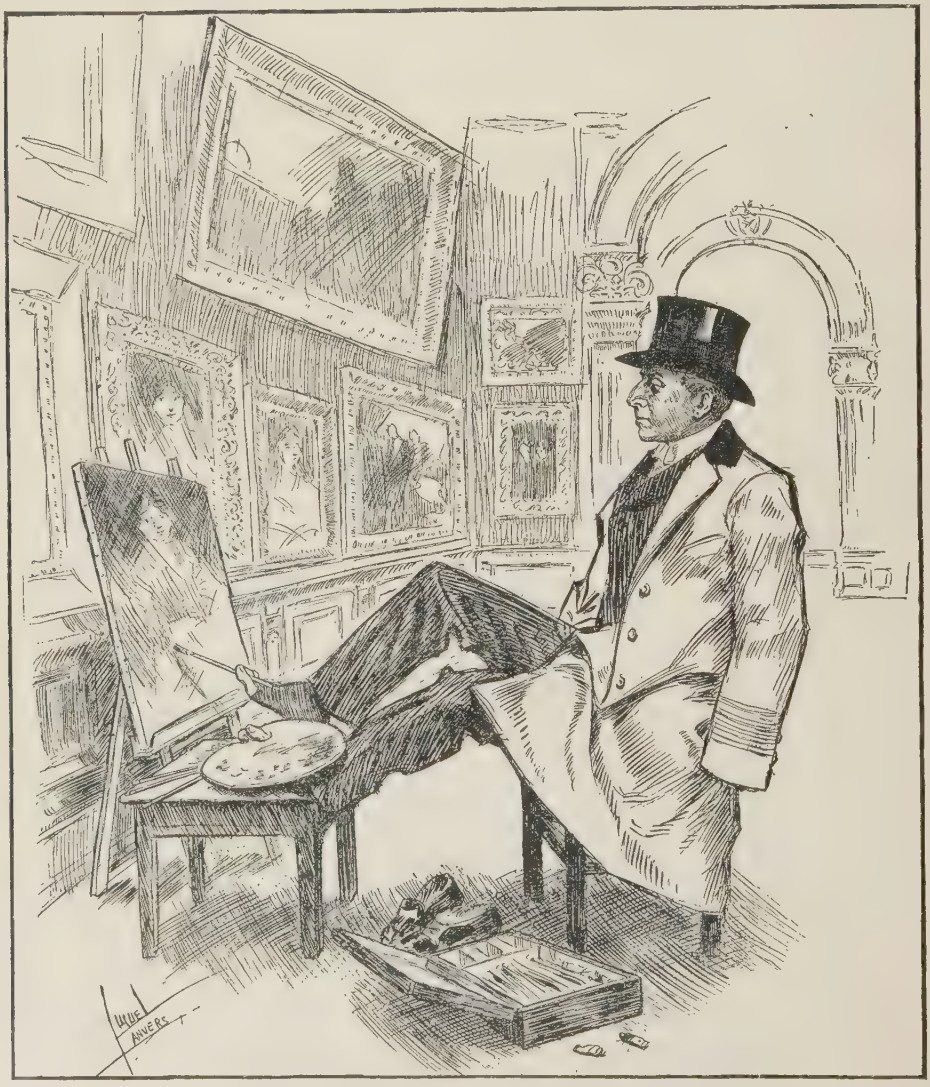
In the first treatise published on railways by Nicholas Wood, the writer deprecates any attempt at a greater speed than fourteen miles an hour upon railways. Yet this shortsightedness was exceeded by a writer in the Quarterly Review:

"What," said the reviewer, "can be more palpably ridiculous than the prospect held out of locomotives traveling twice as fast as stage coaches? We should as soon expect the people of Woolwich to suffer themselves to be fired off upon one of Congreve's ricochet rockets as trust themselves to the mercy of such a machine going at such a rate. We will back old Father Thames against the Woolwich railway for any sum. We trust that Parliament will, in all railways it may sanction, limit the speed to eight or nine miles an hour, which, we entirely agree with Mr. Sylvester, is as great as can be ventured on with safety."

The locomotive steam engine dates long after the railway; and the directors of the Liverpool and Manchester Railway were the first to use it.

AN ARTIST WITHUOT ARMS

A VERY remarkable man is Charles Felu, of Antwerp. He was born Felu was born in 1830, and in his second year he began to use his feet instead



AN ARTIST WHO PAINTS WITH HIS FEET.

without arms and yet has achieved success and fame as a portrait painter. of hands. He succeeded admirably and in a very short time was remarkably pro-

ficient. However, to use his feet for ordinary purposes in place of the hand he was not satisfied, so he tried to write with pen and pencil. He succeeded in doing some clever work and a pen and ink drawing which he made opened his way into the Antwerp Academy.

In the museum at Antwerp and Kensington Museum, London, he copied the works of the old masters, and in his tours through England and the United States he always found plenty of buyers for his artistic productions. Among his patrons were the King of Portugal, the Dowager Queen of Spain and King Leopold II. Later he devoted his time and talent to portrait painting in which he has become famous.

STORY OF A PIRATE

Career, Capture and Execution of the Most Noted Freebooter of the Century.

NOTWITHSTANDING a new generation has come upon the stage of human affairs, since "Gibbs, the Pirate," startled the world by his bold and atrocious career on the high seas, his deeds are still read of, rehearsed and listened to with the same wondering interest and involuntary shudder, as when, in the days of their actual occurrence, they broke fresh upon the ears of an astonished and outraged community— a career which, in spite of the destiny that inevitably awaits such a course of crime against mankind, seemed for years to defy and baffle all the efforts of pursuit and of retributive justice.

From the various accessible resources of information concerning this notorious adept in piracy and blood, it appears that his native place was Providence, R. I., his real name, James D. Jeffers, having been given up and that of Charles Gibbs substituted. Bearing this name, at the very mention of which mankind would afterwards shudder, he became, in the widest and most ghastly sense of the term ever applied to man, the "Scourge of the Ocean."

In November, 1830, there sailed from New Orleans for Philadelphia, the brig "Vineyard," Captain William Thornby, with William Roberts as mate, and the following crew: Charles Gibbs, John Brownrigg, Robert Dawes, Henry Atwell, James Talbot, A. Church and Thomas I. Wansley, a young negro native of Delaware, who acted as cook. When the "Vineyard" had been five days at sea, Wansley made it known to the crew that there were $50,000 in specie on board.

This information excited their cupidity, and induced them to secretly consult as to whether and how they could get the money into their own hands. Many con-

versations took place on the subject, and while these were going on, Dawes, who was a mere boy, was sent to converse with the officers, in order to divert their attention from what was passing.

Resolved to Kill Them.

Finally, the resolution was taken, that as the master and mate were old men, it was time they should die and make room for the rising generation. Moreover, they were of the opinion that as the mate was of a peevish disposition he deserved death. It does not appear, however, that Brownrigg or Talbot had any part in these plans, or in the foul deed that resulted from them. The conspirators agreed to commit the fiendish crimes of murder and piracy on the night of the twenty-third. The murder of the master was, by agreement, assigned to Gibbs and Wansley, and that of the mate to Atwell and Church. This plan was carried out.

The pirates took possession of the vessel, and Wansley busied himself in wiping up the blood that had been spilled on the deck, declaring, with an oath, that though he had heard that the stains of the blood of a murdered person could not be effaced, he would wipe away these. Then, after drinking all round, they got up the money. It was distributed in equal portions to all on board; Brownrigg and Talbot being assured that if they would keep the secret and share the plunder they should receive no injury.

They then steered a north-easterly course toward Long Island, till they came within fifteen or twenty miles of Southampton Light, where they resolved to leave the vessel and take to the boats, though the wind was blowing very hard. Atwell scuttled the brig and got into the jolly-boat with Church and Talbot, while Gibbs, Wansley, Dawes and Brownrigg, put off in the long-boat. The jolly-boat swamped on a bar two miles from the shore, and all on board were drowned.

The long-boat was also in great danger, and was only saved from a like fate by throwing over several bags of specie. Nevertheless, the crew at last got on shore at Pelican Island, where they buried their money, and found a sportsman who told them where they were. They then crossed to Great Barn Island, and went to the house of a Mr. Johnson, to whom Brownrigg gave the proper information. Thence they went to the house of a Mr. Leonard, where they procured a wagon to carry them farther.

Called Them Murderers.

As they were about to get in, Brown rigg cried aloud that they might go where they pleased, but he would not accompany them, for they were murderers. On hearing this, Mr. Leonard obtained the presence of a magistrate, and Gibbs and Dawes were apprehended. Wansley escaped into the woods, but was followed and soon taken. The maritime, and indeed the whole civilized world, breathed freer when the news spread abroad of the great pirates' capture.

The evidence of the guilt of the accused was full and conclusive. Their own confession of the crime, voluntarily made to Messrs. Merritt and Stephenson, who had the custody of them from Flatbush to New York, could have left not the shadow of a doubt on the mind of any person who heard the testimony of those officers. Wansley told the whole story,

occasionally prompted by Gibbs; and while both admitted that Brownrigg was innocent, their confession was not so favorble as to Dawes.

Found Guilty.

Gibbs was arraigned for the murder of William Roberts, and Wansley for that of Captain Thornby, and, being found guilty, judgment in accordance with the law was pronounced. During the trial, the iron visage of Gibbs was occasionally changed by a transient emotion; he had evidently abandoned all hope of escape, and sat the greater part of his time with his hands between his knees, calmly surveying the scene before him. Wansley was more agitated, and trembled visibly when he rose to hear the verdict of the jury.

And now, as was to be expected, there was revealed the bloody annals of Gibbs' ill-starred career.

It was in the latter part of 1813 that he entered on board a ship bound to New Orleans and thence to Stockholm. On the homeward passage they were forced to put into Bristol, England, in distress, where the ship was condemned, and he proceeded to Liverpool. He returned to the United States in the ship "Amity," Captain Maxwell.

Shortly after his arrival home, the death of an uncle put him in possession of about two twousand dollars, with which he established himself in the grocery business in Boston, an undertaking which did not prove profitable, so that he was often under the necessity of applying to his father for assistance, which was always afforded, together with the best advice. The stock was finally sold at auction for about nine hundred dollars, which he soon squandered in tippling-houses and among profligates. His father, hearing of his dissipation, wrote affectionately to him to come home, but he stubbornly refused, and again turned his attention to the sea.

Sailing in the ship "John," Captain Brown, bound for the island of Margaretta, he left the ship soon after its arrival at that place, and entered on board the Colombian privateer "Maria," Captain Bell. They cruised for about two months in the Gulf of Mexico, around Cuba, but the crew becoming dissatisfied in consequence of the non-payment of their prize-money, a mutiny arose, the crew took possession of the schooner and landed the officers near Pensacola.

Hoisted the Black Flag.

A number of days elapsed before it was finally decided by them what course to pursue. Some advised that they should cruise as before, under the Colombian commission; others proposed to hoist the black flag. They cruised for a short time without success, and it was then unanimously determined to hoist the black flag and wage war against the commerce of all nations. Their bloody purpose, however, was not carried into full and immediate execution; for though they boarded a number of vessels, they allowed them to pass unmolested, their being no specie on board, and their cargoes not being convertible into anything valuable to themselves.

At last, one of the crew, named Antonio, suggested that an arrangement could be made with a man in Havana, that would be mutually beneficial; that he

would receive all their goods, sell them and divide the proceeds. This plan being received favorably, they ran up within two miles of Moro Castle and sent Antonio on shore to see the merchant and make a contract with him.

Began Capturing Vessels.

Previous to this, Gibbs was chosen to navigate the vessel. Antonio succeeded in arranging everything according to their wishes, and Cape Antonio was appointed to be the place of rendezvous. The merchant was to furnish facilities for transporting the goods to Havana, which he did for more than three years.

The "Maria" now put to sea with a crew of about fifty men, mostly Spaniards and Americans, with every expectation of success. The first vessel she fell in with was the "Indispensable," an English ship bound to Havana, which was taken and carried to Cape Antonio. The crew were immediately destroyed; those who resisted were hacked to pieces; those who offered no resistance were reserved to be shot and thrown overboard. The maxim to which they scrupulously adhered, was, "that dead men tell no tales."

According to Gibbs' statement, he never had occasion to give orders to begin the work of death. The Spaniards were eager to accomplish that object without delay, and generally every unhappy victim disappeared in a very few minutes after the pirates' feet trod the deck of the fated vessel.

Gibbs now directed his course towards the Bahama Banks, where they captured a brig, believed to be the "William," of New York, from some port in Mexico, with a cargo of furniture, destroyed the crew, took the vessel to Cape Antonio, and sent the furniture and other articles to their accomplice in Havana. Sometime during this cruise, the pirate was chased for nearly a whole day by a United States frigate, supposed to be the "John Adams;" he hoisted patriot colors and finally escaped. In the early part of the summer of 1817, they took the "Earl of Moria," an English ship, from London, with a cargo of dry goods.

Crew and Ship Destroyed.

The crew were destroyed, the vessel burnt and the goods carried to the Cape; here the pirates had a settlement with their Havana agent, and the proceeds were divided according to agreement. Gibbs repaired personally to Havana, introduced himself to the merchant, and made arrangements for the succeessful prosecution of his piracies. While there he became acquainted with many of the English and American naval officers, and, adroitly concealing his own character and calling, inquired respecting the success of their various expeditions for the suppression of piracy and all their intended movements.

On the return to Cape Antonio, Gibbs found his comrades in a state of mutiny and rebellion, and that several of them had been killed. His energy checked the disturbance, and all agreed to submit to his orders and put any one to death who should dare to disobey them.

During the cruise, which was made in the latter part of 1817 and the beginning of 1818, a Dutch ship from Curacoa was captured with a cargo of West India goods and a quantity of silver plate. The passengers and crew, to the number

of thirty, were all killed, with the exception of a young and beautiful female, about seventeen, who, in the midst of the awful scene of death-blows and shrieks and mangled corpses, kneeled upon the gory deck and piteously implored Gibbs to save her life.

Promised to Save Her.

The appeal was successful and he promised to save her, though he knew it would lead to dangerous consequences among his crew. She was carried to Cape Antonio and kept there about two months, but the dissatisfaction increased until it broke out at last into open mutiny, and one of the pirates was shot by Gibbs for daring to lay hold of her with a view to beating out her brains. Gibbs was compelled, however, to submit her fate to a council of war, at which it was decided that the preservation of their own lives made her sacrifice indispensable.

He therefore acquiesced in the decision, and gave orders to have her destroyed by poison, which was immediately administered to her, and thus the young, beautiful and unfortunate creature was launched into the other world.

Shortly after this the piratical schooner was driven ashore near the cape, and so much damaged that it was found necessary to destroy her. A new, sharp-built schooner was in consequence provided by their faithful ally in Havana, called the "Picciana," and dispatched to their rendezvous.

In this vessel they cruised successfully for more than four years. Among the vessels taken and destroyed, and their crews and passengers remorselessly hurried into eternity, were the "Belvidere," "Dido," a Dutch brig, the British bark "Larch," and many others.

Gibbs further stated that he had been concerned in robbing forty different vessels. He gave the names of upwards of a score of vessels taken by the pirates under his command, the crews of which had been murdered.

Some time in the course of the year 1819, Gibbs left Havana for the United States, carrying with him about thirty thousand dollars. He passed several weeks in New York, and then went to Boston, whence he took passage for Liverpool, in the ship "Emerald." Before he sailed, however, he had squandered a large part of his money in dissipation and gambling. He remained in Liverpool a few months and then returned to Boston in the ship "Topaz." His residence in Liverpool at that time was testified to by a female in New York, who was well acquainted with him there, and where, as she stated, he lived like a wealthy gentleman. In speaking of his acquaintance with this female, Gibbs said:

Was Deceived.

"I fell in with a woman who I thought was all virtue, but she deceived me, and, I am sorry to say, that a heart that never felt abashed at scenes of carnage and blood was made a child of for a time by her, and I gave way to dissipation and torment. How often, when the fumes of liquor have subsided, have I thought of my good and affectionate parents, and of their godly advice! But when the little monitor began to move within me, I immediately seized the cup to hide myself from myself, and drank until the sense of intoxication was renewed. My

friends advised me to behave like a man, and promised me their assistance but the demon still haunted me, and I spurned their advice."

He readily admitted his participation in the "Vineyard" mutiny, revolt and robbery and in the murder of Thornby; and so impressed was he with the universal detestation and horror which his heinous crimes had excited against him, that he often inquired if he should not be murdered in the streets, in case he had his liberty, and was recognized. He would also frequently exclaim, "Oh, if I had got into Algiers, I should never have been in this prison to be hung for murder!"

Stubborn to the Last.

Though he gave no evidence of contrition for the horrible and multiplied crimes of which he confessed himself guilty, yet he evidently dwelt upon their recollection with great unwillingness. If a question was asked him, in regard to how the crews were generally destroyed, he answered quickly and briefly, and instantly changed the topic either to the circumstances attending his trial or to his exploits in Buenos Ayres.

On being asked why with such cruelty he killed so many persons, after getting all their money, which was all he wanted, he replied that the laws themselves were responsible for so many murders; that, by those laws, a man has to suffer death for piracy, and the punishment for murder is no more, besides all witnesses are out of the way, and, consequently, if the punishment was different, there would not be so many murders.

Gibbs and Wansley paid the penalty of their crimes. Both prisoners arrived at the gallows about twelve o'clock, accompanied by the marshal, his aids and a body of United States marines. Two clergymen attended them to the fatal spot, where, everything being in readiness, the ropes were adjusted about their necks and prayers offered. Gibbs addressed the spectators, acknowledging the heinousness of his career, and adding:

"Should any of the friends of those whom I have been accessory to, or engaged in, the murder of, be now present, before my Maker I beg their forgiveness—it is the only boon I ask—and, as I hope for pardon through the blood of Christ, surely this request will not be withheld by man, from a worm, like myself, standing, as I do, on the very verge of eternity! Another moment, and I cease to exist—and could I find in my bosom room to imagine that the spectators now assembled had forgiven me, the scaffold would have no terrors.

"My first crime was piracy, for which my life would pay the forfeit on conviction; no punishment could be inflicted on me farther than that, and therefore I had nothing to fear but detection, for had my offenses been millions of times more aggravated than they now are, death must have satisfied all."

Gibbs shook hands with Wansley, the officers and clergymen, the caps were then drawn over the faces of the two criminals, and a handkerchief dropped by Gibbs as a signal to the executioner caused the cord to be severed, and in an instant they were suspended in the air. Wansley expired with only a few slight struggles. Gibbs died hard.

GREATEST BATTLES OF THE INDIAN WARS

ALL historians agree in declaring that the defeat of General St. Clair in 1791 by the Indians of the Northwest Territory was the most signal and disastrous ever sustained by the American army in its battles with the warriors of the forest.

On the other hand, this defeat, the news of which fell like a thunderbolt upon the then struggling and distracted government, was retrieved by a most complete and decisive victory under General Wayne over these same tribes, collected together in a vast and powerful horde, at the rapids of the Maumee in 1794, a victory which, taken in connection with the subsequent overwhelming triumph of General Jackson in his campaign against the Creeks, gave the finishing stroke to the power of the Indian race in North America.

It settled forever the long struggle that had been carried on between the white man and the red man in favor of the former, though the warlike propensities of the savages occasionally broke out in subsequent years, as in 1811, under Tecumseh ; the Creek war of 1814, under Weatherford ; the terrible Seminole campaign ; the Cherokee contest ; the hostilities of the Sacs, Foxes and Winnebagoes, under Black Hawk ; the renowned Florida war of 1835, under Micanopy and Osceola, etc. These atter wars taxed to the utmost the military skill of such trained soldiers as Jackson, Harrison, Worth, Harney, Jessup, Clinch, Thompson, Dade, Atkinson, Gaines, Taylor. Red Jacket and Cornplanter were prominent chieftains in the wars of the Senecas.

In the month of September, 1790, General Harmer was intrusted with the important duty of looking after the fierce tribes on the Miami and Wabash, between whom and the Kentuckians there had long raged a relentless war. The general went forward with a body of three hundred and twenty regulars, who being re-enforced by the militia of Pennsylvania and Kentucky formed a corps of one thousand four hundred and fifty-three men. The Indians on his approach set fire to their villages ; but this was nothing unless they could be brought to an engagement.

Harmer, however, instead of advancing himself with the main body sent forward Colonel Hardin with two hundred and ten men, of whom only thirty were regulars. They were attacked, the militia fled, the others were nearly cut off. The general then sent forward Hardin with three hundred men, who speedily encountered another large body. After a brave contest,

in which this party lost nearly half their number, they retreated on the main body. Thus disaster followed disaster and the nation became sore and mortified under such repeated humiliations.

Washington in Command.

One of the last measures, therefore, adopted by the United States Congress, the ensuing year, 1791, was to augment the national military force to a suitable degree of power and to place in the hands of President Washington more ample means for the protection of the frontier, as the Indians on the northwest side of the Ohio still continued their hostilities. A new expedition against the belligerent tribes had in consequence been projected, and General St. Clair, then governor of the territory west of the Ohio, was appointed commander of the forces to be employed.

Washington had been deeply chagrined by the mortifying disasters of General Harmer's expedition to the Wabash, resulting from Indian ambushes. In taking leave, therefore, of his old military comrade, St. Clair, he wished him success and honor, and added this solemn warning:

"You have your instructions from the Secretary of War. I had a strict eye to them, and will add but one word—Beware of a surprise! You know how the Indians fight. I repeat it—Beware of a surprise!"

With these warning words sounding in his ear, fresh with Washington's awful emphasis, St. Clair departed.

On the fourth of November, while the main body of St. Clair's army were encamped in two lines on rising ground, some fifteen miles south of the Miami villages, on one of the tributaries of the Wabash, and the militia upon a high flat on the other side of the stream, they were surprised and terribly attacked by an Indian force which lay concealed in the woods. General St. Clair, who was suffering severely from gout, was unable to mount his horse and had to be carried about in a litter, from which he gave his orders with discretion and the most perfect coolness. The battle raged fearfully for nearly three hours, and, after nearly half of his army had been slaughtered, St. Clair beat a headlong retreat.

Plans Overthrown.

Thus were all the plans, hopes and labors of President Washington, Congress and the Cabinet, in reference to the Indian campaign, utterly and deplorably overthrown in a single day. This result is stated to have arisen thus: On the third of November St. Clair formed his force into two lines; the first, under the command of General Butler, composed the right wing, and lay with a creek immediately in their front. The left wing, commanded by Colonel Darke, formed the second, and lay with an interval of about seventy yards between them and the first line. The militia were advanced beyond the creek, about a quarter of a mile in front.

About half an hour before sunrise the next morning, just after the troops had been dismissed from the parade, an unexpected attack was made upon the militia, who fled in the utmost confusion, and, rushing into camp through the first line of regular troops, which had been formed the instant the first gun was discharged,

threw them, too, into disorder. Such was the panic, and so rapid and irregular the fight, that the exertions of the officers to recall the men to their senses and to duty were quite unavailing.

At Point of Bayonet.

It was soon perceived that the American fire could produce, on a concealed enemy, no considerable effect, and that the only hope of victory was in the bayonet. At the head of the second regiment, which formed the left of the left wing, Darke made an impetuous charge upon the enemy, forced them from their ground with some loss, and drove them about four hundred yards. He was followed by that whole wing; but the want of a sufficient number of riflemen to press this advantage, deprived him of its benefit, and, as soon as he gave over the pursuit, the Indians renewed the attack.

In the meantime, General Butler was mortally wounded, the left of the right wing was broken, the artillerists almost to a man killed, the guns seized, and the camp penetrated by the enemy. Orders were given to again charge with the bayonet; this was done with spirit and momentary success, the Indians being driven out of the camp and the artillery recovered.

To save the remnant of the army was all that now remained to be done; and, about half-past nine in the morning, General St. Clair ordered Colonel Darke, with the second regiment, to charge a body of Indians, who intercepted their retreat, and to gain the road. Major Clarke, with his battalion, was directed to cover the rear. These orders were executed, and then a disorderly fight commenced. The pursuit was kept up about four miles, when, fortunately for the surviving Americans, the victorious savages, eager for plunder, stopped at the camp of their vanquished foes to divide the spoils.

The routed troops continued their flight to Fort Jefferson—some thirty miles—throwing away their arms along the road. At this place they met the detached regiment, and leaving their wounded at Fort Jefferson, the army continued its retreat to Fort Washington, the site of the present city of Cincinnati.

Two Ruinous Defeats.

Poor St. Clair's defeat has been aptly paralleled with that of Braddock. No doubt, when he realized the terrible havoc that had been made, he thought sadly of Washington's parting words, "Beware of a surprise!" The manner in which the news of this disaster affected Washington is thus described by Mr. Rush:

Towards the close of a winter's day, in December, an officer in uniform was seen to dismount in front of the President's house in Philadelphia, and, giving the bridle to his servant, knock at the door of the mansion. Learning from the porter that the President was at dinner, he said he was on public business, having dispatches which he could deliver only to the commander-in-chief. A servant was sent into the dining-room to give the information to Mr. Lear, the President's private secretary, who left the table and went into the hall, where the officer repeated what he had said. Mr. Lear replied that as the President's secretary, he would take charge of the dispatches and deliver them at the proper time.

The officer made answer that he had

just arrived from the western army, and his orders were explicit to deliver them with all promptitude, and to the President in person, but that he would await his directions. Mr. Lear returned, and in a whisper imparted to the President what had passed. General Washington rose from the table and went to the officer. He was back in a short time and made a word of apology for his absence, but no allusion to the cause of it. He had company that day. Everything went on as usual. Dinner over, the gentlemen passed to the drawing-room of Mrs. Washington, which was open in the evening. The general spoke courteously to every lady in the room, as was his custom. His hours were early, and by ten o'clock all the company had gone.

The Chief's Anguish.

Soon Mrs. Washington left the room, and the General and Mr. Lear remained. The chief now paced the room in hurried strides, and without speaking, for several minutes. Then he sat down on a sofa by the fire, telling Mr. Lear to sit down. He rose again, and, as he walked backward and forward, Mr. Lear saw a storm gathering. In the agony of his emotion, he struck his clenched hands with fearful force against his forehead, and in a paroxysm of anguish, exclaimed :

"It's all over! St. Clair's defeated—routed ; the officers nearly all killed—the men by wholesale—that brave army cut to pieces—the rout complete. Too shocking to think of—and a surprise in the bargain!"

He uttered all this with great vehemence. Then he paused and walked about the room several times, agitated, but saying nothing. Near the door he stopped short and stood still a few seconds ; then, turning to the Secretary, who stood amazed at the spectacle of Washington in all his terrors, the general, in his wrath, again broke out, saying :

A Solemn Warning.

"Yes, sir ; here, in this very room, on this very spot, I took leave of him ; I wished him success and honor. 'You have your instructions,' I said, 'from the Secretary of War ; I had a strict eye to them, and will add but one word—beware of a surprise! I repeat it—beware of a surprise! You know how the Indians fight us.' He went off with that as my last solemn warning thrown into his ears. And yet, to suffer that army to be cut to pieces, hacked by a surprise—the very thing I guarded him against! O God! O God! he's worse than a murderer! How can he answer it to his country? The blood of the slain is upon him—the curse of widows and orphans—the curse of heaven!"

This torrent came out in tone appalling. His very frame shook. "It was awful!" said Mr. Lear. More than once he threw his hands up as he hurled imprecations upon St. Clair. Mr. Lear remained speechless—awed into breathless silence. Presently the roused chief sat down on the sofa once more. He seemed conscious of his passion, and uncomfortable. He was silent ; his wrath began to subside. He at length said, in an altered voice :

"This must not go beyond this room."

Another pause followed—a longer one—when he said, in a tone quite low,

"General St. Clair shall have justice. I looked hastily through the dispatches—

saw the whole disaster, but not all the particulars. I will hear him without prejudice; he shall have full justice; yes, long, faithful and meritorious services have their claim."

The Storm Over.

Washington was now perfectly calm. Half an hour had gone by; the storm of indignation and passion was over, and no sign of it was afterwards seen in his conduct or heard in his conversation. His wrath on this occasion was perhaps never before aroused to so great a pitch, except when he confronted Lee when the latter was retreating at the battle of Monmouth.

St. Clair was succeeded by the brave General Wayne, whose successes retrieved the misfortunes of his predecessor, as the following stirring record will show. It will be interesting, however, to have some account of the character and personal appearance of Michikiniqua, or "Little Turtle," the Missesago chief, who conquered St. Clair, for in no recorded battle did the sons of the forest ever show themselves better warriors or achieve more renown at home and abroad.

Notwithstanding his name, Little Turtle was at this time at least six feet high, strong, muscular, and remarkably dignified in his manners, though of a very sour and morose countenance, and apparently very crafty and subtle. He was the son of a Miami chief, and was forty-five years of age when he led his warriors against poor St. Clair. His warlike training was of that stern and hardening kind which was never omitted in his nation.

It was on the banks of the Miami, or Maumee, in 1794, that General Anthony Wayne, the successor of St. Clair in the command of the American Army in the Miami country, dealt a retributive and staggering blow to the power of the Indians in that vast and magnificent region, — a blow from which they never recovered.

Realizing the terrible shock which the nation received by the defeat of St. Clair, the brave Wayne—"Mad Anthony," as he was commonly called, on account of his reckless courage—at once made the best of his way to the theatre of action, for it was easy to foresee, what indeed immediately ensued, that, under the encouragement of the successes against Harmer and St. Clair, all the treaties would be dissolved, and a general savage confederacy formed against the United States.

Works of Defense.

On the eighth of August, 1794, Wayne had reached the confluence of the Au Glaize and the Miamis of the lakes without opposition. The richest and most extensive settlements of the Indians were here. Halting at this place a few days, the Americans threw up some works of defense. A fort had also been built on the St. Mary, twenty-four miles in advance of Fort Recovery.

Unwilling to lose time, or to be in any way outwitted, Wayne moved forward on the fifteenth of August, and on the sixteenth met his messenger returning from the Indians, and bearing word from them that, if the Americans would wait ten days at Glaize, they, the Indians, would decide for peace or war. Wayne's only notice of this evasive message was to

march straight on, arriving, on the eighteenth, at the rapids; here they halted, and labored the next day in erecting works for the protection of their baggage.

How Troops Were Disposed.

At eight, on the morning of the twentieth, the American Army moved down the north bank of the Maumee; Wayne's legion was on the right, its flank covered by the Maumee; one brigade of mounted volunteers was on the left, under Brigadier General Todd; and the other was in the rear, under Brigadier-General Barbee. A selected battalion of mounted volunteers moved in front of the legion, commanded by Major Price, who was directed to keep sufficiently advanced, so as to give timely notice for the troops to form in case of action, it being yet undetermined whether the Indians would choose peace or war.

Wayne says, in his official dispatch, that, after advancing about five miles, Major Price's corps received so severe a fire from the enemy, who were secreted in the woods and high grass, as to compel them to retreat. The legion was immediately formed into two lines, principally in a close thick wood, which extended for miles on the left, and for a very considerable distance in front; the ground was covered with old fallen timber, probably occasioned by a tornado, which rendered it impracticable for the cavalry to act with effect, and afforded the enemy the most favorable covert for their mode of warfare. The savages were formed in three lines, within supporting distance of each other, and extending for nearly two miles at right angles with the river. Wayne soon discovered, from the weight of their fire and the extent of their lines, that the enemy were in full force in front, in possession of their favorite ground, and endeavoring to turn the American left flank. He therefore gave orders for the second line to advance and support the first, and directed Major-General Scott to gain and turn the right flank of the savages, with the whole of the mounted volunteers, by a circuitous route; at the same time, the front line was ordered to advance and charge with trailed arms, and rouse the Indians from their coverts at the point of the bayonet, and when up to deliver a close and well-directed fire on their backs, followed by a brisk charge, so as not to give them time to load again.

Orders Quickly Obeyed.

All these orders were obeyed with spirit and promptitude; but such was the impetuosity of the charge by the first line of infantry, that the Indians and Canadian militia and volunteers were driven from their coverts in so short a time, that, although every possible exertion was used by the officers of the second line of the legion, and by Generals Scott, Todd, and Barbee, of the mounted volunteers, to gain their proper positions, only a part of each could get up in season to participate in the action, the enemy being driven, in the course of one hour, more than two miles, through the thick woods, by less than one half their numbers.

Thus did this powerful horde of savages, who had assumed to dictate terms and throw down the gauntlet to the American nation, abandon themselves to flight, and flee in terror and dismay before Wayne and his victorious army.

They were compelled to sue for peace on the conqueror's own terms; their confederacy was shattered into fragments; their power was forever annihilated.

On the return of Wayne to Philadelphia, then the nation's capital, there was a cessation of all business, as on some great holiday. The military turned out in legions to meet him; the bells rang out their merriest peals, cannon boomed from every hill-top, and the plaudits of the multitude attended him at every step. General Harrison's defeat of the Indians under Tecumseh, at Tippecanoe, in 1811, was another victory of similar brilliancy and importance, deserving of mention.

It only remains to add to this chapter General Jackson's crowning achievement in the work of grinding to powder the military prestige of the Indian race in North America. The Creeks and Seminoles had long disputed the intrusion of the white race, and, though dreadfully cut to pieces in the battles of Talluschatches, Talladega, Emuckfaw, Enotochopco and others, determined to make one more great and final struggle in the field.

Accordingly, with consummate sagacity and skill, they selected a position at the great bend of the Tallapoosa, called by them Tohopeka, and by the whites Horseshoe Bend. Here, strongly fortified, were collected together the proudest, fiercest, most victorious warriors of all that race and region. On the 27th of March, 1814, Jackson advanced and attacked them with tremendous energy, the troops leaping over the walls of the fort and engaging in a hand-to-hand combat with the savages, the latter fighting with characteristic fury and desperation.

Of the nine hundred warriors—the flower of their tribes—who defended the fort, seven hundred and fifty were killed or drowned; for, seeing no chance of escape, and scorning to surrender, they fought with bloody energy until nearly all were slain.

MARVELOUS ACHIEVEMENTS OF ASTRONOMY

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THE achievements of astronomy during the nineteenth century have been little short of marvelous. Not only have the classic methods of research been expanded and developed, but in the latter half of the century new instruments of unexpected power have been perfected and results obtained by their use in fields

utterly closed to the astronomers of a hundred years ago.

Mathematical analysis reached a high state of perfection in the researches of Laplace and Lagrange at the century's beginning; the labors of profound analysts like Gauss, Adams, Le Verrier, Gylden, Hill, Newcomb and many others have placed mathematical astronomy on an entirely new footing.

Triumphs of Mathematics.

It is impossible in a popular paper to give any account of the triumphs of mathematicians. It must suffice to say that the advances in the theory of the motions of the heavenly bodies are as important by the spectroscope, the photometer and the photographic plate. One signal result stands out as a brilliant type of the power of analysis.

The planet Neptune was discovered with the telescope in 1846 in consequence of laborious calculations by Le Verrier (and Adams) upon the materials of the planet Uranus. Uranus had been discovered by chance by Sir William Herschel in 1781. A body of unusual appearance was seen in this telescope, Examination showed that it was a major planet revolving about the sun in eighty-four years.

Careful observations gave the shape and size of its orbit. Calculations of the perturbing forces exerted by the other known major planets—Mercury, Venus, the earth, Mars, Jupiter, Saturn—showed that its course in space would be along a certain line if these planets, and only these, affected its motion. Renewed observations showed very slight yet obvious deviations from the predicted course. It occurred to several astronomers—to Argo, Bessel, Struve, Le Verrier, Adams—that these deviations were produced by the attraction of a major planet as yet unknown.

Sir John Herschel wrote of the new planet a few weeks before its discovery in memorable words: "We see it as Columbus saw America from the shores of Spain. Its movements have been felt trembling along the far-reaching line of our analysis with a certainty hardly inferior to ocular demonstration."

Great Problem Solved.

The extraordinary complex problem of inverse perturbations was worked out by Le Verrier and by Adams, and the place where the new planet would be found was foretold. When the telescope was directed to the predicted place the unknown planet was there; the mathematician, in his study, had directed the observer's telescope. Other achievements of the same order of merit, though far less striking, have distinguished the present century.

In the mathematical processes relating to spherical and to practical astronomy, also, this century has made its mark in history. Bessel, Struve and their successors in Europe and America have reconstructed these branches of the science from the foundations. Every pupil in our colleges is now familiar with the highest refinements of observation and calculation; and the principles of instrument-making have been carried well-nigh to perfection. In some departments the instruments furnished are so perfect that the outstanding errors of observation are due chiefly to the human being who uses the apparatus, not to the apparatus itself.

The distances of the sun and of many of the stars have been fixed with exactness. The heavens are assiduously watched, by professionals and amateurs, in all the length and breadth of the globe, and no change of importance can take place without being detected—perhaps by photography—and reported by the electric telegraph to every interested watcher in all the continents.

Aid of Photography.

The advent of photography as the handmaid of astronomy marks a distinct advance in the process of observation. The sensitive plate partially records all rays of light that fall upon its surface. Such a plate directed at the heavens shows thousands upon thousands of stars, each registered in its proper position and of its proper brightness. A second plate taken upon a succeeding night records all changes, either of position or of brilliancy.

It is in this way that new minor planets are discovered (by their change of position), new variable stars detected (by their change of brilliancy). Maps of the whole sky are now made by photography, and they record millions upon millions of stars. The inventory of the stellar universe will soon be completed, a magnificent gift of this century to the next. Photography has proved to be of immense importance in the study of the moon.

A satisfactory picture of the full moon can be made in less than a second of time, which will show more than is contained in the best lunar maps that required a lifetime to construct by the old methods.

The mysterious world of the nebulae, too, is depicted by means of photography with extraordinary faithfulness, the work of years of observation being compressed into hours. Up to this time little success has been attained, however, in the study of planetary features by photography and the old methods of telescopic examination and pictorial representation by drawings are still employed. It is partly for this reason that so much remained doubtful in the accounts of the surface details of Mars, Jupiter, etc.

In the study of the physical characteristics of comets, also, photography has proved to be of the very first importance. Features quite impossible to see with the eye are distinctly shown on the negative plate; and in this field we are on the very verge of great discoveries. The connection of comets with meteor swarms is a fact of capital importance.

Famous Telescope.

The electric telescope has revolutionized certain parts of astronomy and geodesy. All longitudes are now fixed by the "American method" with unheard of accuracy and rapidity, and the figure of our globe will soon be well determined. One of the striking discoveries of the century is Dr. Chandler's detection of a minute regular change of the axis of rotation of the earth whose effect is shown in a regular, though small, variation of the latitude of places.

This discovery is an excellent example of the thoroughness with which all astronomical work—both observation and calculation—is now performed.

Newton's discovery of universal gravitation reached no further than the outermost planet known to him—Saturn. The discovery of Uranus and Neptune extended the scope, but Herschel's detection

of systems of binary stars revolving about each other according to this law made gravitation truly universal; the law was effective to the boundaries of the universe. Our knowledge of double stars has been vastly extended by the discoveries of this century. Thousands of such systems have been discovered, and many orbital motions are already calculated.

The Sun is a Star.

The Nebular Hypothesis of Laplace (published in 1796) had declared that the sun and all the planets were but condensations from a single vast nebula that once filled all space. The spectroscope proves that the stars, the sun and the earth are made up of the same elements. If the earth were to be raised to the temperature of the sun, it would be like it—a miniature sun.

The sun is, in fact, a star. The stars are, in general, composed of terrestrial elements. This great generalization strengthens the nebular hypothesis in its larger acceptations, but the century has brought forward many doubts as to its minor details. With the discovery of the spectroscope, the science of astronomical physics was born. The most amazing single result of spectroscopic observation is the determination of the velocity with which stars are approaching to or receding from the earth.

All stars are in motion with respect to the earth. As they move away from or towards us, the pitch of their spectral lines is altered by their velocity, precisely as the pitch of the bell of a passing locomotive engine is altered by its motion toward us or from us. The motion of the sun and of the whole solar system among the stars, in space, can be determined in this fashion. We are approaching some stars; we are receding from others. The line of the motion of our whole solar system can thus be drawn in the universe, and this problem is now being worked out in all its details at several places, notably at the Lick Observatory.

In the foregoing paragraphs it has not been possible to note more than a few of the greater achievements of the astronomy of the last century. Only a few of the greater men are named. A full account of astronomical progress would require a volume, and it would include a host of honored names. In each and ever department we should find Americans in the highest places. Nowhere has astronomy flourished better than upon our own soil, and we may look forward to the next century with confidence.

Brilliant Wonders.

A wise man only wonders once in his life, but that is always; the fool never. The education of the wise man begins with wonder, and ends with devout admiration; but the fool "doth not consider," and shuts his eyes to things around him. Strictly speaking, wonder is not a vulgar nor a foolish attribute. All wonder, said a dogmatic writer, is but the effect of novelty upon ignorance. Nay, we answer, you cannot be ignorant if you would feel the greatest effect of wonder. Thus it is that Coleridge, a most learned man, declares, "in wonder all philosophy began, in wonder it ends, and admiration fills the interspace; but if the first wonder is the offspring of ignorance, the last is the parent of adoration and devout religious emotion."

WOMEN EQUAL TO OUTDOOR WORK

THE accompanying illustration is an unusual one, and must appear very singular to our readers. The fact that women in any part of the world should be expected to drag a road roller seems to us very strange.

Our American ideas do not fall in with the custom of having outdoor work performed by women, although this is sometimes done in order to save crops from destruction, or because there is a scarcity of male help. The higher forms of civilization confine woman's work to indoors.

WOMEN OF INDO-CHINA ROLLING THE ROADS AT HAI-FONG.

It should be remembered, however, that in many parts of Europe, women labor out of doors just as men do. They frequently perform even the heavy kinds of work which we would naturally think belong exclusively to men. The writer of this has seen the female peasantry of Belgium and other countries toiling in the harvest fields, and apparently doing the same amount of work as the stronger sex.

THE BUILDER OF EMPIRES

Remarkable Career of Cecil Rhodes—Story of the Young Contractor's First Venture—His Bequest to Our Country.

"SO much to do, so little done!"

"Yes, those were just the words Rhodes would say," said Mr. Alfred Mosley. Mr. Mosley was making a visit to the United States preliminary to his bringing over two commissions to inquire into the technical education and industrial conditions of America.

"We South Africans, who worked with him and have known him as he was, regard him as the greatest Englishman of the century. There is no one whose death brings me a sense of greater loss. But I was prepared for it when, just before he left England for the last time, I found he was unable to see his friends. I had known him for thirty years, and as our friendship dated from early Kimberley days he had always till then been ready for a conversation.

"Even the Rothschilds, when they wanted to talk over some matters before his departure, were told he was obliged to decline. Dr. Jameson, who watched him so constantly, made a big fight, and it was probably the knowledge of his alarming condition and the wish to keep his thoughts from himself that accounted for those restless, hurried movements to Scotland and to Egypt.

"And yet Rhodes' death will not now, I think, seriously affect South Africa. His work has been set on a sure basis. Rhodesia before long may be expected to come under imperial administration, the Chartered Company giving up its privileges on fair terms. The Cape to Cairo railway is nearing completion to Tanganyika, and the finish of the telegraph line through Africa is only a matter of months. Thus his great plans are in fair course of fulfilment.

"Rhodes was a big man in every sense of the word," continued Mr. Mosely. "He thought in empires. From the very first he nourished great schemes in his head, though he kept them to himself. For money in itself he had absolutely no use whatever. When we were young and working on the Kimberley mining field—and we had to work hard for our living—if you met him he looked like one you would give a quarter to.

"He was known then as the 'young contractor.' His undertaking, when he was still in his teens, to pump the water out of the Kimberley mines gave him the title.

"When did I come across him first? We were both small claimholders, and we put up together for election to the mining board. We thought the smaller men were likely to be swamped by the bigger. I remember the election as well as if it were yesterday—Rhodes standing against the door and good humoredly exchang-

ing chaff with the miners, who were jeering him. But in six months' time the other men were out and we were in.

Permanent Capital.

"Cape Town itself can never lose its position as the capital of the premier colony, though Johannesburg, perhaps, in ten years' time will have a population of half a million. Cape Town will be the New York of South Africa, as it is the 'stepping off' place for the southern portion of the continent, the terminus of the main lines and the focus of parliamentary and social life.

"I am not at all surprised at the report that Rhodes has left the bulk of his fortune to a scheme for developing the education of 'younger Britain,' though, of course, I cannot say how far it is correct. Nor should I care to commit myself to any estimate of the amount of his fortune to be disposed of, though I do not myself see how it may exceed $25,000,000.

"As to his interest in education, however, I know that I heard him make an interesting speech at a town meeting in Rhodesia, about eighteen months ago, and from the way he spoke it was evident that he had given much thought to the subject. You may be sure that any provision he has made in his will in that direction will be a carefully elaborated scheme.

"At that meeting, which was called to decide about providing schools in Salisbury, I was particularly struck with the way in which Rhodes proposed to deal with the 'religious difficulty.' He told the townsmen that it was his intention to provide as part of the educational system in Rhodesia that rooms should be provided in each schoolhouse for the various denominations to have religious instruction under their own ministers at a stated time. He was the son of an English clergyman, you may remember, and that seemed to me to show on what broad lines he wished to solve a burning question. His gift of scholarships in the English universities to American students was just like him; he was broad-minded in every way."

Four Diamond Mines.

"Of the four big diamond mines at Kimberly at that time the De Beers was looked upon as a hopeless case. The claims and shares were going almost for an old song. That was because the sides had fallen in at the top and the floating drift of the upper strata was found unremunerative. Rhodes conceived the notion of boring through the drift to the strata below. His foresight was correct. The diamondiferous clay came up as it were in a pipe through solid rock.

"Knowing he had a good thing Rhodes set himself to buy up every claim he could get hold of. The area at the top was about fourteen acres. With the means of working then available and without the machinery brought afterward into use, it was impossible for the small men to carry their claims downward. I was one who sold claims to Rhodes.

"They might be worth millions to-day. But Rhodes quietly, by borrowing and by the belief he inspired, managed to get the chief control, and thus set on foot the amalgamation of which the De Beers is the principal factor to-day. You can work down to two thousand feet, but there is no sign of the diamonds giving out. The

only limit I see is perhaps in one hundred and fifty years' time reaching such a depth as will be unworkable."

"Equal Rights for All."

"What part would Rhodes have taken in the future settlement of South Africa had he lived? You may be sure he was prepared to take his share in developing the federation of the various States. The policy is 'equal rights for all,' the Boers as well as the English population. The Transvaal and Orange River colonies will go through the preliminary stage of imperial administration as crown colonies. The same process was followed in the case of Kimberley and the northern section of Cape Colony, till it was incorporated as part of the self-governing colony under the Parliament at the Cape.

"The Transvaal comprises about one hundred and twenty thousand square miles, and includes three gold mining districts of importance—the famous Witwatersrand and the quartz mining districts of Lydenburg and De Kaap. The entire mineral development of the country has taken place within a few years, for mining in the Transvaal was prohibited up to 1868, at which time the government, being in dire financial straits, threw open the gold fields to exploration, even going so far as to offer a bonus for the discovery of profitable mines.

"The resultant prospecting in the early seventies led to the discovery of quartz veins and the inauguration of mining in several parts of the Northern Transvaal. The Lydenburg district first attracted attention in 1876, when exploration of the alluvial deposits began, followed later by vein mining. The De Kaap gold fields were discovered in 1884, and the conglomerate or "blanket" beds of the Witwatersrand — destined to supersede all others in importance—in 1885.

"In that year a small stamp battery was erected to crush quartz from a vein a few miles west of Johannesburg, and in this a crushing of conglomerate was made; but it was not until April, 1887, that a battery of three stamps was erected to treat the ore of the Witwatersrand.

Large Output of Gold.

"This was followed by the erection of other batteries, and the output of gold for 1887 was 23,000 ounces. For 1898, the last complete year before the war, it was 4,295,659 ounces, valued at $75,705,880, and for nine months of 1889 it was 4,008,326 ounces. There were at the end of 1898 seventy-nine mines, which in 1898 produced 7,331,446 tons of ore, crushed by 4,765 stamps. They employed 9,476 whites, with an average monthly wage of $130, and 88,627 native workmen, receiving on an average about $13 each a month.

"During the same year in the Lydenburg district five companies, running 137 stamps, produced 154,560 tons of ore, yielding 108,884 ounces of crude gold, and in the De Kaap gold fields seven companies, running two hundred stamps, produced 89,760 ounces of crude gold.

"The companies ceased working in October, 1899, by reason of the declaration of war, but the late Transvaal Government continued operations upon its own account in some of the richest mines up to May, 1900. In May, 1901, crushing operations were resumed by the companies."

GREATEST AUTHORS, ORATORS, AND STATESMEN

Allen, Elizabeth Ackers.

THIS American poet was born at Strong, Maine, October 9, 1832. She became a contributor to various magazines and under the pseudonym of "Florence Percy" became widely known as an author. A volume of poems published in 1867 was favorably received. In 1860 she became the wife of Paul Ackers, the sculptor, but survived her husband, and some time after his death was married to Mr. E. M. Allen, of New York.

Her painstaking work has been widely appreciated, and while her productions are not so abundant as those of many others, she has gained an enviable distinction as a graceful writer, with fine poetic taste. Her beautiful poem entitled, "Rock Me to Sleep, Mother," has become a household treasure. It exalts and ennobles motherhood, and its tender pathos is universally admitted.

Andersen, Hans Christian.

A well-known magazine, the Quarterly Review, says concerning this author: "For vividness and reality of detail, for breadth and boldness in the description of scenery, and for skill in conveying the impression made on a fine mind and earnest heart by all that is beautiful in nature and true in art, he stands without a rival among recent writers of romance."

This is high commendation, yet it accords with the judgment of multitudes who have been charmed by his writings. Not only have his works been widely circulated in his own country, but they have been translated into many foreign languages. The young, especially, have found instruction and entertainment in his delightful stories and fairy tales, published in several volumes, and which are characterized by vivid imagination, quaint humor and not infrequently profound pathos.

Andersen was born in Odense, in the island of Funen, April 2, 1805. His father's family was one of some note and at one time had been rich, but when Hans was born had fallen into poverty.

He was fortunate enough in early life to meet several influential friends who enabled him to obtain an education at the expense of the State. At an early age he

wrote several poems, among which "The Dying Child" was particularly admired. From this time he entered upon an upward career and surprised and delighted the public by his tales and romances. Some of his volumes of travels have had a wide circulation. He died in August, 1875. On his seventieth birthday he was presented with a book containing one of his tales in fifteen languages.

Bancroft, George.

He is principally distinguished as the author of the history of our country, but not without note as a diplomatist and statesman. He was born in Worcester, Mass., October 3, 1800. At the age of thirteen he entered Harvard College, graduated with high honors in 1817, and spent two years in study at Gottingen, Germany, where in 1820 he received the degree of Doctor of Philosophy. Returning to America in 1822 he served a year as a Greek tutor in Harvard College, when he and Dr. Cogswell, a fellow tutor, established the Round Hill School at Northampton, Mass., with which Bancroft was associated until 1830. In 1823 he published a volume of poems, and subsequently made translations from the German of the minor poems of Goethe, Schiller, etc., and of some of the historico-political works of Heeren.

In 1834 appeared the first volume of his "History of the United States from the Discovery of the Continent," followed by the second and third volumes in 1837 and 1840, respectively, the whole embracing "The History of the Colonization of the United States." These were succeeded in the interval from 1852 to 1860 by five volumes narrating the history of the colonial period to the Declaration of Independence, and in 1866 and 1874, respectively, by the two concluding volumes, bringing the history to the treaty of peace with the mother country in 1782. Bancroft subsequently published "The History of the Formation of the Constitution of the United States" (2 vols., 1882), which afterwards formed a constituent part of the revised edition of the complete "History of the United States," embraced in six volumes (1882-84).

Bancroft served as Collector of the Port of Boston (1838-41) under President Van Buren, and was an unsuccessful candidate for the governorship of Massachusetts in 1844. He accepted a seat in the Cabinet of President Polk as Secretary of the Navy in 1845, and the following year was appointed Minister to the Court of St. James, a position which he filled until 1849, with honor to his country. A period of retirement from public life followed his return to America. In the Civil War he was heartily in accord with the national government, and in 1867 he was appointed by President Johnson Minister to Berlin, serving with distinguished ability until recalled at his own request in 1874. The American press contained highly appreciative notices of Mr. Bancroft's character and work on the occasion of his death, January 17, 1891.

The high character of Mr. Bancroft and his great ability as an author and diplomat, which have been universally recognized, place him in the highest rank of eminent Americans. Blessed with a strong physical constitution, excellent health, a cheerful disposition, and maintaining almost to the last his physical vigor by horseback riding, he serves as an

ideal for the aspirations of our young men. He left behind an honored name.

Blaine, James Gillespie.

Mr. Blaine was born of Scotch-Irish parentage at West Brownsville, Pa., January 31, 1830. As a boy at school he excelled in literature and mathematics, and at the early age of thirteen entered Washington College in his native county, graduating in 1847. Subsequently he became a teacher in the military institute at Blue Lick Springs, Ky., where he married Miss Harriet Stanhope, a teacher in a neighboring seminary. Soon after his marriage he removed to Pennsylvania, and after studying law for a short time became a teacher in the Institution for the Blind at Philadelphia. In 1854 he removed to Augusta, Me., entering the journalistic ranks, first as editor of the Kennebec Journal, and later as editor of the Portland Advertiser.

In 1862 the Republicans elected him to the House of Representatives, and for twenty years he served in one or the other of the two Houses of Congress. During the war he favored all judicious and practical resolutions for its vigorous prosecution, and at its close he bore an active part in the reconstruction measures of the country. The fourteenth constitutional amendment was called the "Blaine Amendment," as it was formulated and earnestly advocated by him. He was largely instrumental in the negotiation of a treaty with England, in which the doctrine of perpetual allegiance was abandoned, and Great Britain accepted the American principle of equal rights and protection for adopted as well as for native citizens. From 1869 to 1875 Mr. Blaine was Speaker of the House of Representatives, and his record in this capacity is generally conceded to have been a brilliant one.

In 1876 Mr. Blaine was elected to the United States Senate, and at once became a most prominent and efficient member of that body. In the Republican national convention of that year he was a prominent candidate for nomination to the presidency of the United States, and lacked only 28 votes out of a total of 754 of receiving the nomination. At the Republican national convention in 1880 his friends again presented his name for nomination, and on the first ballot the vote stood: Grant, 304; Blaine, 284; Sherman, 93; Edmunds, 34; Washburn, 30; Windom, 10; Garfield, 1. On the election of Mr. Garfield, Mr. Blaine accepted the appointment of Secretary of State, filling the office with rare ability and success, until the death of the President, when he retired from active public work, and began to write his famous historical work, entitled, "Twenty Years in Congress."

In 1884 Mr. Blaine received the Republican nomination for President, but after a vigorous contest, failing to secure the electoral vote of the State of New York by the narrow margin of 1047 votes out of a total of over 1,200,000, he was defeated in the general election. He spent the ensuing four years at work on his book and in foreign travel.

At the time of the nominating convention in 1888, Mr. Blaine was in Europe, and by formal letter declined to permit his friends to present his name as a candidate for the presidency. He returned, however, in time to aid efficiently in the

canvass for Mr. Harrison, and on the election of the latter again accepted the appointment as Secretary of State. Among the important services rendered in this office he took a leading part in settling the Samoan difficulties in the treaty between Germany, England and the United States, and successfully invited and most efficiently presided over the Pan-American Congress held in Washington. In June, 1892, Mr. Blaine resigned his office to become a candidate for the Republican Presidential nomination, but failed to receive it. He died in 1893.

Boker, George H.

Mr. Boker is known especially for his "War Lyrics," published in 1864, in some of which the scenes of the Civil War are depicted with graphic force. His first volume was entitled, "The Lesson of Life and Other Poems," and appeared in 1847. Several other volumes followed in rapid succession, all of which were well received by the reading public. That he is entitled to a conspicuous place among American poets is generally conceded.

Born in Philadelphia, October 6, 1823, he graduated at Princeton in 1842, and studied law, but never practiced. He was a man of some prominence in public affairs, and in 1871 was appointed Minister to Constantinople, and in 1874 Minister to St. Petersburg. He was the editor of Lippincott's Magazine several years. His death occurred in Philadelphia, January 2, 1890.

Booth, Edwin.

Edwin Booth was born at Baltimore, Maryland, on November 15, 1833. He was the fourth son of Junius Brutus Booth, himself the foremost actor of his day. The elder Booth was thirty-seven years old when Edwin was born; he was at the height of his powers and fame. Between the father and this son a special sympathy existed, undemonstrative, but deep and lasting. So, while he was yet but a child, he was taken from school to accompany his father about the country on his dramatic tours. Edwin's education, therefore, was obtained by fits and starts. It was supplemented by much experience of the world, both of its caresses and its buffetings.

The result was that he grew up thoughtful, observant, rather moody, strong in judgment, self-reliant, inflexible of will. He was reticent, too, and modest, and received both praise and blame with equanimity. In time, from being his father's pet, he became his comrade, and then at last his guardian and his master, the only one who could advise and influence that inspired but wayward genius.

Early in his career Edwin Booth went with his father and brother, the latter named for the father, to California, and played at San Francisco and Sacramento. There each of the three had a benefit performance. First came that of the father, Junius Brutus Booth, in which he played "Richard III," the sons taking minor parts. Next came the benefit of Junius Brutus Booth, junior, that actor playing "Othello" to his father's "Iago." Last came Edwin's benefit and he played "Jaffier" to his father's "Pierre." It was on that occasion, Edwin being costumed in black, that his father remarked casually, "Ned, you do look like 'Hamlet.' Why didn't you choose 'Hamlet' for to-night?"

To which the young man answered carelessly, "At my next benefit I will." This was his first leaning toward the great part of which he became the world's greatest exponent, and with which his name must be forever intertwined.

At great cost he erected in New York such a theatre as never before had been dreamed of in this country. It was the architectural gem of the city. Its dimensions were vast, its seating capacity enormous. Its visual and acoustic properties were perfect. Upon its stage the greatest plays could be enacted with every possible spectacular accessory. The scenery was gorgeous, and every mechanical equipment was provided. Here Mr. Booth gathered about him a company of the best actors and actresses in America, and gave representations of the greatest dramas with a perfection of detail and ensemble such as had before been unknown.

The result was that the unappreciative public left his theatre empty and flocked to see the "cheap and nasty" sensational plays that third-rate "barnstormers" produced at rival houses. Mr. Booth was bankrupt, his own and his friends' fortunes swept away and only debts left to remind him of his glorious ambition. He for years lived with the utmost economy, in order to make good to his creditors and his friends the losses of his theatre. That done, he accumulated a handsome fortune for himself. His fame as an actor was unrivaled. He died in 1893.

Brooks, Phillips.

This eminent American clergyman, was born in Boston, December, 13, 1835. He graduated at Harvard College in 1855, and studied at the Divinity School near Alexandria, Virginia, and was ordained in 1859. From this year until 1869 he held Episcopal rectorships in Philadelphia.

Mr. Brooks was a man of most imposing presence, possessed of rare scholarship and eloquence, and attracted marked attention from the beginning of his public ministry. His discourses were profound in thought, elevated in spiritual sentiment, abounded in gems of rare beauty, and deeply impressed the cultivated audiences that listened to them. Having been called to a rectorship in Boston, his fame increased, and a short time before his death, which occurred in January, 1893, he was elevated to the House of Episcopal Bishops.

Browning, Elizabeth Barrett.

Mrs. Browning must be considered one of the most gifted poetesses of our time, her work appealing especially to people of intellectual refinement and cultivated taste. In person, she was slight, with dark hair and complexion; an easy, modest manner and cordiality drew to her many friends. She was born at Durham, March 6, 1809. Her father, Mr. Barrett, was a wealthy merchant of London, who gave his daughter, in early life, the best opportunities for education. At ten years of age she exhibited fine poetical talent, which was diligently cultivated.

In 1846 she was married to the poet, Robert Browning, with whom she resided in Italy for many years. She produced, in 1851, "Casa Guida Windows," a poem which treats of the political condition of Italy. "This," says the North British

Review, "is the happiest of Mrs. Browning's performances, because it makes no pretensions to high artistic character, and is really a simple story of personal impressions." Her largest, and withal her greatest work, is "Aurora Leigh," a poem, or novel in verse, which is greatly admired. This was published in 1856, and in the same year a new edition of her poems was issued in three volumes. She died at Florence, Italy, in June, 1861.

Browning, Robert.

This most subtle and intellectual of contemporary English poets was born at Camberwell, May 7, 1812. His father, a man of parts, was engaged in the city of London. The future poet, after receiving local education, attended lectures at University College, and then traveled abroad. From his earliest years he had been accustomed to write verse, and, while still a youth, acquired the triple reputation of poet, musician and modeler.

"Pauline," a dramatic poem, written at the age of nineteen, was published in 1833. Two years later appeared his "Paracelsus," which revealed a greater force. Its energy, its boldness of thought, its lofty aspirations, and its grip of human passion, stamped the author as one of the most promising of the younger poets.

In his later poems, the poet pressed into his service, in a masterly degree, humor, pathos, passion and tenderness; while the whole were distinguished for their ringing and melodious versification. Browning married, in 1846, Elizabeth Barrett, herself a poetess of high and noble gifts, and with her he went to Florence, where they lived in perfect and happy union. In 1850, Browning published "Christmas Eve and Easter Day," poems which defended catholicity in religion—the good to be discovered in the varying forms of Christianity.

The "Browning Society" was established in 1881 for the purpose of promoting the study and influence of the poet's works, and the example of London has been followed by many other large centres in Great Britain, the colonies and the United States. As a poet, Browning is distinguished for his capacity in creating real men and women, and also for the depths of his spiritual insight. His lyrical faculty, dramatic energy and power of psychological analysis have rarely been equaled. Besides being one of the most erudite of poets, he has intense human sympathy and high imaginative gifts, and a profound vigorous faith. His style is too frequently obscure and difficult, his versification hard and rugged, and his rhymes forced. Mr. Browning died in December, 1889.

Bryant, William Cullen.

Mr. Bryant easily ranks among the first American poets, and in some respects excels all others. A profound love of nature, fine poetic fancy, love of home and country and easy versification characterize his works, which have struck the popular heart and have been widely read. It is perhaps not a little singular that his most famous poem, "Thanatopsis" was written while yet he was a young man at Williams College.

Mr. Bryant was born in Hampshire county, Mass., on the 3rd of November, 1794. In college he distinguished himself in the languages, became a student of law in 1812, and afterward practiced

law for several years. He removed to New York City in 1825, and soon after became one of the editors of the Evening Post, which he continued to edit with great ability until his death.

A collection of his poems was published in 1832. Soon after he visited Europe and traveled in Egypt and Syria, writing letters home, which were afterward collected into a volume entitled, "Letters of a Traveler." Mr. Bryant was always a warm advocate of political reforms, opposed the extension of slavery, and ardently supported the Union during the Civil War. "No poet," says Griswold, "has described with more fidelity the beauties of the creation, or sung in nobler song the greatness of the Creator. He is the translator of the silent language of the universe to the world." His translations from foreign languages are graceful and accurate reproductions of the originals, rivaling those of Longfellow. Died June 12, 1878.

Byron, Lord.

Byron's genius flashed out like a brilliant meteor, compelling attention, and for the most part admiration. He was born in London, January 22, 1788. In early life he exhibited strong passions, an almost ungovernable will, and, at times, a rashness which occasionally appeared even in his later years. Among his mates he was courageous, quick to take an insult, and was never satisfied until it had been resented. In 1805 he went to Trinity College, Cambridge, which he left two years after without a degree.

During his stay at the university, he published a volume of poems, entitled, "Hours of Idleness," which was very severely criticised in the Edinburgh Review. The poet wrote by way of retaliation, his "English Bards and Scotch Reviewers," a caustic and scathing satire, which at the time caused a great sensation and convinced the critics that Byron's genius was not to be terror-stricken or reduced to silence by "paper bullets of the brain."

In 1809 he traveled throughout Europe, and while in Greece, surrounded by the classic associations of that country, he warmly espoused the cause of Greek independence, a theme which inspired some of his loftiest strains. On his return to England he published the first two cantos of "Childe Harold's Pilgrimage," the success of which was so sudden and extraordinary that, as he tells us, "he awoke one morning and found himself famous." Soon after he took his seat in the House of Lords, to which by birth he was entitled. Byron wrote easily and rapidly. His various works followed one another in rapid succession. Some of his most pathetic verses were inspired by the infelicities of his domestic relations.

That he had great faults is universally admitted, nor can it be denied that his genius was of the highest order. Macaulay's critical pen places him in the front rank of modern poets, and declares he has never been excelled in the expression of scorn, misanthropy and despair, and that there is not a single note of human anguish of which he was not master. He died on the 19th of April, 1824, at the early age of thirty-six, yet had already achieved undying fame.

Byron's erratic yet splendid genius is everywhere apparent in his poetical productions, which always held high rank.

Campbell, Thomas.

Author of "The Pleasures of Hope" and many other poems marked by true poetic genius, was a native of Scotland, and was born at Glasgow, in 1777. After a brilliant literary career he died at Boulogne in 1844, and was buried in Westminster Abbey, Lord Macaulay, Dean Milman and other celebrities acting as pall-bearers. Few poems of any author have become more generally known or have been received with greater favor. His poems entitled, "Hohenlinden," "Lochiel" and "Gertrude of Wyoming" have been universally popular, and were known to all the school-children of our own country a generation ago.

Carlyle, Thomas.

This distinguished and withal eccentric author gained by his writings a wide celebrity for originality, graphic description and vigorous English. Bold in thought, a hater of shams, rugged in matter and manner, his striking essays forced themselves upon the attention of the public. Mr. Carlyle must be considered as one of the most brilliant authors of his day. The work that gave him the greatest reputation was his "History of the French Revotion," which depicted with remarkable force the bloody scenes of that social and political convulsion. Born at Ecclefechan, Scotland, in 1795. Died February 5, 1881.

Carnegie, Andrew.

Mr. Carnegie was born at Dunfermline, in Scotland, on the 25th of November, 1835. When he was twelve years of age he emigrated to America and settled at Pittsburg with his parents and a younger brother. He was then almost penniless. He afterwards accumulated many millions, and wields an influence in the industrial world as great, possibly, as that of any living man. It may be said that Mr. Carnegie was exceptionally equipped for success both mentally and morally, numbering among his mental qualities shrewdness, persistence, a good memory and an intuitive insight into character, and among his moral qualities integrity, gratitude and geniality.

But his phenomenal rise in life must be attributed largely to his following certain clear principles and methods. Some of these he defined in an admirable address to the students of a commercial college at Pittsburg. These are his maxims, summarized:

"Avoid drink; avoid speculation; avoid endorsements. Aim high. For the question, 'What must I do for my employer?' substitute 'What can I do?' Begin to save early—'capitalists trust the saving young man.' Concentrate your energy, thought and capital; fight it out on one line." (The lack of concentration he considers the failing of American business men.)

To these injunctions he might well have added another, suggested by his own career: "Never think your education ended."

Mr. Carnegie's benefactions have been enormous, reaching many million dollars. Numerous towns have fully equipped public libraries which have been furnished by his well-known maxim, "No man should die rich."

Cary, Alice.

This well-known American authoress first came into notice by her contribution

to the National Era, for which she wrote under the *nom de plume* of "Patty Lee." Her "Clovernook," comprising sketches of western life, was popular both in America and England. Several works of fiction and various poems have also met with marked favor. Born near Cincinnati, Ohio, 1820, died in New York, where she resided during the latter part of her life, in 1871. She was also gifted in the portrayal of domestic scenes and the charms of country life.

The writings of the Cary sisters have long been familiar to the American people, their moral tone, felicitous expression and elevated sentiment having given them wide popularity. From their gifted pens have come several hymns that have gained a high degree of favor. It is rarely that two members of the same family exhibit so high an order of genius.

Cary, Phœbe.

She was the younger sister of Alice and equally gifted. Her birthplace was the Miami Valley, where she was born in 1824; her death occurred in 1871. She published independently several volumes of buoyant pleasant verse and contributed a third of the "Poems of Alice and Phœbe Cary," published in 1850. During the latter years of their life the Cary sisters resided in New York, were actively engaged in religious work, and were greatly beloved by a large circle of friends.

Choate, Rufus.

A scholarly American lawyer, born in Essex, Massachusetts, October 1, 1799, graduated at Dartmouth in 1819, and was admitted to the bar in 1823. He sat in Congress from 1830 to 1834, when he settled in Boston. Here his singular eloquence rapidly advanced him to the place of leader of the Massachusetts bar; indeed, it has been claimed for him that he was the most eminent advocate New England or even America, has produced. After a term in the United States Senate, 1841–45, he returned to his profession; in 1859, his health giving way, he sailed for Europe, but stopped at Halifax, Nova Scotia, where he died, July 13th. His writings, with a memoir, were published at Boston in 1862.

Clay, Henry.

When reference is made to America's greatest orators it is customary to mention the name of Henry Clay among the very first. He was frequently called, "The Mill Boy of the Slashes," from the fact that he was a poor boy and was born in a district in Virginia called "the Slashes." The date of his birth was April 12, 1777, and he died at Washington, June, 1852.

He served successively in the Kentucky Legislature, State Senate, United States House of Representatives and Senate and was one of four candidates for President in 1824, and also a candidate in 1844, being defeated both times.

In person, Mr. Clay was tall and slender, had a voice of wonderful range and sympathy, was remarkably easy and graceful in manner, and few orators who ever lived possessed such persuasive power. "Take him for all in all," says Parton, "we must regard him as the first of American orators; but posterity will not assign him that rank, because posterity will not hear that matchless voice, will not see those large gestures, those striking attitudes, that grand manner, which gave to second-

rate composition first-rate effect. His speeches will long be interesting as the relics of a magnificent and dazzling personality, and for the light they cast upon the history of different parties."

Cleveland, Grover.

Among men who have had the nerve to meet the demands of rapidly unfolding destiny Grover Cleveland stands conspicuous. He was born at the modest village of Caldwell, Essex county, N. J., March 18, 1837. His father, Richard F. Cleveland, was the pastor of the village Presbyterian church. His mother was Anna Neal, the daughter of a bookseller and publisher of Baltimore, Md. In 1841 the Caldwell pastor moved to Fayetteville, Onondaga county, N. Y., and thence, after nine years, to Clinton, in Oneida county, and in 1853 to Holland Patent, near Utica, where he died after a settlement of but three weeks, leaving a widow and nine children, of whom Grover was the third. This noble mother lived to rear all her children and passed from earth in April, 1882.

Having been admitted to the bar in 1859, Mr. Cleveland made rapid advances, and in January, 1863, he was appointed Assistant District Attorney for the county of Erie, and in 1870 was elected Sheriff. On the expiration of his term in this office he resumed his legal practice and was pushed rapidly to the forefront in local politics, and was also an active worker in the leading literary and historical efforts of the community. In 1881 he was elected to the mayoralty of Buffalo by a solid majority, and took office January 1, 1882.

He was subsequently elected Governor of New York by the Democratic party, and was nominated for the Presidency of the United States and elected in 1882. Having served his party well he was re-elected President in 1892, retiring from public life at the expiration of his term. Mr. Cleveland was an advocate of a low tariff, a conservative leader, a wise counselor and a conscientious executive.

Cross, Marian Evans Lewis (George Eliot).

An English writer of remarkable power, the daughter of Robert Evans, a surveyor. She was born November 22, 1819, and subsequently became one of the most distinguished writers of the century. In 1858 appeared her "Adam Bede," followed by "The Mill on the Floss" (1859), "Silas Marner" (1861), etc., etc., "Middlemarch" appeared in 1872, "Daniel Deronda" in 1876. She was married in the spring of 1880 to a Mr. Cross, and died December 22d of the same year.

Depew, Chauncey M.

This distinguished citizen, prominent in railroad affairs and politics, was born in Peekskill, N. Y., in 1834, and graduated from Yale College in 1856. As a young man Mr. Depew came into notice as an effective stump-speaker and an orator who could adapt himself to almost any public occasion. Genial in disposition, with an unlimited fund of anecdotes and remarkable fluency of speech, he has become widely known and universally popular.

In 1861 he was a member of the Legislature of New York, and two years later was elected Secretary of State, subsequently holding the position of president of the "Vanderbilt Roads." His

writings consist of addresses and orations delivered on various occasions, all of which are finished productions and place their author among the foremost orators of America. Mr. Depew has always taken an active interest in politics. His services are sought in every Presidential campaign, and what he has to say commands wide attention. He was elected to the United States Senate from New York in 1899, and took his seat on December 4th of that year.

Dickens, Charles.

The name of Gladstone, or Napoleon, or Lincoln, or McKinley, is not better known than that of Pickwick, or Macawber, or Pecksniff, or Uriah Heap, or Mark Tapley, or Barkis, or Sairy Gamp, or Little Nell, or many others that might be mentioned, all of which, although fictitious, seem quite as real as any historic character, from Julius Cæser to General Grant. What amazing genius could create these characters and endow them with an endless life? There has never been but one man who could make fictitious character so life like and so universally known, causing them to become, as it were, household names.

The great novelist, whose works of fiction are known and read throughout the civilized world, and who gained a renown unequaled by that of any author of recent times, was born at Portsmouth, England, February 7, 1812. His father wished him to enter the profession of law, but, soon becoming disgusted with it, because he was conscious that it was not his proper sphere, he gave up the study of it, removed to London and became a reporter for the Morning Chronicle. For this paper he began to write sketches that at once attracted attention and showed their author to be possessed of an uncommon faculty for depicting common life, both in its tragic and humorous phases.

Dickens was only twenty-four years old when he published "Pickwick Papers." He immediately sprang into popularity and became the favorite writer of both England and America. His subsequent works, such as "Oliver Twist," "Nicholas Nickelby," "David Copperfield," "A Tale of Two Cities," "The Old Curiosity Shop" and many others, all served to increase his reputation, although it was predicted that he would soon "write himself out." He maintained his reputation by his wonderful creations in the realm of fiction and the charm of his transcendent genius.

Many of his works show intense sympathy with the lower classes and the struggling poor, the hard worked sons and daughters of toil and those who are the victims of greed and oppression. It is not too much to say that some of the most important reforms in England which benefited the laboring classes could be traced directly to the influence of his magic pen. Mr. Dickens came to this country on two occasions. On the first he angered many of his admirers by his caustic comments on American society and customs. On the second occasion he appeared as a public reader of his own works, and was welcomed by thousands in all our larger cities. Work was his element; in fact, overwork, from which he undoubtedly died June 9, 1870, and was buried in "Poets' Corner," Westminster Abbey, among the great celebrities of old England.

Emerson, Ralph Waldo.

Few names in American literature represent so much of that kind of thought which sets others thinking, and influences them as does the name of Ralph Waldo Emerson. He was born in Boston, Massachusetts, in 1803, and died in Concord, Mass., April, 1882. His father was a respected minister, and his mother was a woman of more than ordinary mind and education. Emerson graduated at Harvard in 1821, yet did not take high rank in his class. He was successful, however, in obtaining a prize for an English essay. After graduating he became a teacher, and at the same time studied theology under the direction of Dr. Channing.

As a young man he is described as grave, gentle, and never punishing his pupils except by words. Having become a contributor to several magazines, and having written a work on "English Traits," he became somewhat known as an author, yet the product of his mind came slowly, as did the appreciation of the reading public. A vein of philosophy runs through his writings, which appeal especially to those of scholarly tendencies.

His published works comprise, "Nature: Addresses and Lectures;" "Essays," first and second series; "Representative Men;" "The Conduct of Life;" "Society and Solitude;" "Letters and Social Aims;" "Poems;" "Lectures and Biographical Sketches;" "Miscellanies." Emerson wrote occasionally in verse from his schooldays, yet the charm of his poetry is more that of profound thought than of imagination or vivid description. Obtaining the title of "The Concord Philosopher," he frequently appeared in public as a lecturer, but in his later years withdrew from the public gaze and passed his last days in that philosophic repose which might be expected from one of his temperament and peculiar mental characteristics.

Garfield, James A.

The twentieth President of the United States was born in Cuyahoga county, Ohio, November 19, 1831; graduated from Williams College, Mass., in 1856, and adopted the profession of law. In 1856-60 he was a member of the Ohio Senate, and in 1861 entered the army as colonel of the 42d Ohio Volunteers, and was made Brigadier-General in 1862. In 1863 was appointed Chief of Staff to General Rosecrans, and served with him up to the battle of Chickamauga. For gallantry in this action he was promoted to Major-General of the Volunteers, September 19, 1863.

He resigned from the army to take his seat in the 38th Congress from Ohio, and was placed on the Committee of Military Affairs. He continued to serve in Congress upon the most important committees and as Chairman of the Committee on Military Affairs, and also as Regent of the Smithsonian Institute. In 1880 he was elected Senator from Ohio, and at Chicago, on June 8, 1880, selected as the nominee of the Republican party for President of the United States. On the thirty-fifth ballot the vote stood: Grant, 313; Blaine, 257; Sherman, 101; Garfield, 50, besides other scattering votes. On the thirty-sixth ballot the vote counted 309 for Garfield, which gave him the nomination. He was elected by 219 votes in the Electoral College, against 150 for Hancock.

He died at Long Branch, N. J., September 19, 1881, from bullet wounds inflicted in Washington, D. C., by an assassin, July 2, 1881, and was buried at Cleveland, Ohio, amid the lamentations of the whole civilized world. Mr. Garfield was born to command. He was a giant in intellect, an impressive orator, a true-hearted man and an ornament to his country, to the highest position in the gift of which he rose from a poor canal driver in his boyhood.

Gladstone, William Ewart.

Mr. Gladstone may be called the most eminent English statesman, orator and author of the nineteenth century. He was born in Liverpool in December, 1809, and graduated at Oxford in 1831, having gained the highest distinction in classics and mathematics. He was elected to Parliament by the Conservatives in 1832, and appointed a Lord of the Treasury by Sir Robert Peel in December, 1834.

From this time on Mr. Gladstone advanced steadily from one position to another until he was chosen to the very responsible office of Chancellor of the Exchequer in the Cabinet of Lord Palmerston. From being a Conservative Mr. Gladstone gradually adopted Liberal opinions and principles until in 1868 he became Prime Minister. His speeches and orations in Parliament and out were the wonder and admiration of even his opponents. He contemplated great measures for the welfare of his country, including the extension of the suffrage, the formation of public schools and the disestablishment of the Irish Church.

Mr. Gladstone was pre-eminently a scholar, and through all his long and distinguished career he found time to indulge in authorship, some of his published works showing the marked ability which characterized him as a statesman and orator. He passed into a ripe old age laden with honors, and died May 16, 1898. It is enough to say that Mr. Gladstone must be named in that bright galaxy of distinguished men which includes our own Webster and Clay, while in some respects he is easily superior to every other statesman and orator the century has produced.

Gough, John B.

Orator and reformer, whose lectures on temperance and other subjects, delivered throughout America and Great Britain, produced the highest oratorical and dramatic effects, was rescued when a young man from a life of dissipation, and soon arose to unparalleled fame as a platform speaker and temperance advocate. Born at Sandgate, Kent, England, 1817; he came to New York when but a boy, and had a hard struggle with poverty. His later life was marked by comfort and the most happy home influences. Stricken with apoplexy while lecturing at Frankford, near Philadelphia, and died 1886.

Grady, Henry Woodfin.

He was born in Athens, Ga., May 17, 1851, and died in Atlanta, Ga., December 23, 1889. No written memorial can indicate the strong hold which this young orator had upon the Southern people. Although he died at the early age of thirty-eight, his fame was world-wide, and there was perhaps no man in the nation more honored and respected, both North and South, than was this phenomenally gifted writer and speaker during the last few years of his life.

On the 21st of December, 1887, Mr. Grady, in response to an urgent invitation, delivered an address at a banquet of the New England Club, New York, which attracted wide attention. This, and similar speeches, did much to wipe out the prejudices engendered by the war, bridge the bloody chasm, and draw the two sections into a closer union.

Grant, Ulysses S.

General Grant, the eighteenth President of the United States, was inaugurated at Washington with imposing ceremonies, on the 4th of March, 1869. He was born at Mount Pleasant, Ohio, on the 27th of April, 1822. His father was a tanner, and wished him to follow his trade, but the boy had more ambitious hopes, and, at the age of seventeen, a friend secured for him an appointment as a cadet at West Point, where he was educated. Upon graduating, he entered the army. Two years later he was sent to Mexico, and served through the war with that country with distinction. He was specially noticed by his commanders, and was promoted for gallant conduct.

Soon after the close of the war, he resigned his commission, and remained in civil life and obscurity until the breaking out of the Civil War, when he volunteered his services, and was commissioned by Governor Yates, colonel of the Twenty-first Illinois regiment. He was soon made a brigadier-general, and fought his first battle at Belmont. In February, 1862, he captured Fort Henry, and ten days later Fort Donelson, with more than 14,000 prisoners, for which victories he was made Major-General of Volunteers. In the following April he fought a two-days' battle at Shiloh, amongst the severest of the war, in which General A. S. Johnston, commanding the Confederate army, was killed.

Grant's next exploit was the capture of Vicksburg after a long and stubborn siege. The surrender of the stronghold included 31,600 prisoners and 172 cannon. Rapidly he rose to be commander-in-chief of the Federal army, defeated General Lee in the bloody battles of the Wilderness and received Lee's surrender, involving the downfall of the Confederacy, in April, 1865. In 1866 Grant was advanced to the grade of full general, and in May, 1868, he was nominated for the Presidency by the Republican convention, and in the following November was elected.

He was again elected to the Presidency in November, 1872, and proved a wise and successful executive. He died at Mount McGregor, near Saratoga, N. Y., July 23, 1885.

Harrison, Benjamin.

Harrison is an honored name in the history of our country, several members of this family having distinguished themselves in public life, and two of them, William Henry and Benjamin, having been elected to the highest office in the nation. William Henry, "the hero of Tippecanoe," was elected President in 1840 by a large majority over Van Buren, but survived his inauguration only one month.

Benjamin Harrison was elected to the same high office in 1888, receiving the vote of all the old free States except Connecticut and New Jersey. Four years later he was defeated by Grover Cleve-

land, the most commanding figure in the Democratic party during the last two decades of the century.

Mr. Harrison was born at North Bend, Ohio, in 1833, and graduated at Miami University in 1852. He left his law practice in Indianapolis to become colonel of the Seventieth Indiana regiment and during the Civil War served in the Army of the Cumberland. He participated in the capture of Atlanta and was made a brigadier-general. In 1880 he was elected from Indiana to the United States Senate and was soon regarded as one of the strong men in the upper house of Congress. His erudition, forcible speech and honesty of purpose gave him an enviable name, and these qualities he exhibited as the Chief Executive of the nation.

After retiring from the Presidency Mr. Harrison gave lectures upon law in California, and returned to his law practice in which he was always considered as holding the highest rank. Mr. Harrison died March 13, 1901.

Harte, Francis Bret.

Mr. Harte has achieved distinction by his poems in dialect and by his prose works, which make a point of delineating western life and manners. He was first brought to notice by his jingle entitled "The Heathen Chinee," He was born at Albany, New York, August 25, 1839, went to California in 1854, learned the art of printing, and in 1857 became connected with a newspaper, first as printer and finally as editor. For six years, beginning with 1864, he was secretary of the United States Mint at San Francisco. He then connected himself with a magazine called the Overland Monthly, and afterwards held a professorship of recent literature in the University of California. Since that time he has been United States Consul at several foreign ports, at the same time carrying on his literary pursuits.

Many of his books are collections of short tales, skilfully written and possessing undoubted merit. Among his well-known works are, "The Luck of Roaring Camp," "East and West Poems," "Tales of the Argonauts," etc. Mr. Harte died May 6, 1902.

Hawthorne, Nathaniel.

The well-known author of the celebrated "Scarlet Letter" and "House of Seven Gables," together with other works which have placed him in the first rank of modern authors, was born at Salem, Mass., on the 4th of July, 1804. He graduated at Bowdoin College, Maine, in 1825; Longfellow, the poet, being one of his classmates. His nature was extremely sensitive, his disposition retiring, his acquaintances few and his manner gentle and winning. In person he was tall, broad-shouldered and possessed what might be called a majestic presence. Both in mind and body he was constructed to be a commanding figure and made a powerful impression upon all who met him.

Hawthorne made the acquaintance of Franklin Pierce, afterward President of the United States, who did much to cheer him in his fits of despondency, and when he became President, appointed him as our consul at Liverpool, which was the most lucrative office at his disposal. Previous to this, Hawthorne, under Mr. Polk's

administration, was appointed surveyor of the port of Salem, Mass., which he held for three years. In 1850 he published his celebrated "Scarlet Letter," a romance of extraordinary power, and by some considered his masterpiece, although for this distinction it has to compete with his "House of Seven Gables" and his "Marble Faun."

It is generally conceded that in elegance of style, felicity of expression, use of pure English simplicity, clearness and force, he is unrivaled among American authors. The criticism has been made that there is a morbid element in Mr. Hawthorne's writings, a fiery glow of suppressed excitement which renders them unwholesome reading. This judgment, however, is not likely to be accepted by the average reader as strictly correct. He died suddenly at Plymouth, Mass., in 1864.

Holland, Josiah Gilbert.

Dr. Holland is a fine example of an author whose works are pure in sentiment, contain practical every-day helps for the conduct of life, and are admirably suited to the average reader. He was born in Belchertown, Massachusetts, July 24, 1819, and graduated at the Berkshire Medical College, at Pittsfield, in 1844. He soon abandoned his profession, however, and after fifteen months as a school superintendent at Richmond, Va., became assistant editor of the Springfield Republican, of which he was part proprietor also, from 1851 to 1866.

In 1870, with Roswell Smith and the Scribners, he founded Scribner's Monthly, which he conducted successfully till his death, October 12, 1881. In this magazine appeared his novels, "Arthur Bonnicastle" (1873), "The Story of Seven Oaks" (1875), and "Nicholas Minturn" (1876). His "Timothy Titcomb's Letters" (1858) went through nine editions in a few months, and this sale was succeeded by his "Life of Lincoln" and his most popular poems, "Bitter Sweet" (1858), "Kathrina" (1867), and "The Mistress of the Manse" (1874). Most of Holland's works have been republished in Britain.

The works of Dr. Holland have been widely read by the American people. His letters to young people have passed through many editions, and are well worthy of a place in every household. They abound in a certain practical sense and homely wisdom which stand in striking contrast to the cheap literature of the day, the influence of which cannot be considered the most healthful.

Holmes, Oliver Wendell.

For many years Dr. Holmes was the most conspicuous figure in the literary circles of Boston. His ripe culture, his poetic genius, his inexhaustible fund of humor and his genial disposition displayed in all his productions, made him one of the best known writers of his time. He was born in Cambridge, Massachusetts, August 29, 1809, and at the age of twenty graduated at Harvard College. His father was a Congregational minister and a writer of some note in his day. After leaving college Dr. Holmes studied law, but soon changed his profession to that of medicine. Having pursued his medical studies in Europe he returned to this country, and in 1838 was elected professor of anatomy and physiology in Dartmouth College, subsequently filling the same chair at Harvard.

While a young man, and before leaving college, he had distinguished himself as a poet and a writer of great originality. One of his first literary successes consisted of contributions to the Atlantic Monthly under the title of "The Autocrat of the Breakfast Table," which were followed later by another series of papers called "The Professor of the Breakfast Table," and "The Poet at the Breakfast Table." These papers were widely read and enjoyed by reason of their subtle thought, quaint humor and deep insight into human nature. He wrote two works of fiction, "Elsie Venner," and "The Guardian Angel." Numerous other productions followed, including poems on various occasions, all of which stamped him as a man of decided genius. He published a biography of his friend Emerson, which showed a just appreciation of the "Concord Philosopher."

Dr. Holmes was especially happy in his verses written for public occasions. His death occurred October 7, 1894, at the ripe age of 85 years. Few American authors have left so distinct an impression upon our literature. His attractive qualities as a neighbor, friend and companion are worthy of especial mention.

Hood, Thomas.

The genius, the poet, whose unrivaled productions by their pathos and humor awaken alternate tears and laughter, most of whose life was a sad struggle with adversity, was born in London, in 1898. His name is associated with the periodical literature of his time, both as manager and author. His best known pathetic pieces are, "The Song of the Shirt" and "The Bridge of Sighs; while "Faithless Nellie Gray" and "Faithless Sallie Brown" are happy specimens of his rollicking humor. Hood died in 1845

Hugo, Victor.

This French celebrity, whose writings are among the most remarkable of any age or country, was born at Besancon in 1802. In early life he exhibited a passion for politics and first employed his pen upon political themes. In 1818 he received prizes for several royalist odes. Through his long and brilliant career he displayed great activity, became a voluminous author of prose and verse, received the highest distinctions that could be conferred upon him by his countrymen and was recognized as a distinct power in politics and literature of France. His rich imagination, wonderful descriptive power and deep sympathy with the suffering poor and unfortunate, serve to render him not only the best known author of France, but by a large majority of his countrymen, the best beloved and the most admired.

Among his most successful and powerful works are, "Notre Dame de Paris," a romance (1831), "Le Roi s'amuse," a drama (1832), "Les Miserables," a novel (1862), "The Toilers of the Sea," (1865), and poems entitled, "The Leaves of Autumn," which, says a French critic, "contain beauties of the first order." He was admitted into the French Academy in 1841, and raised to the rank of peer in 1845. He gave his cordial adhesion to the republic of 1848, and was elected to the Constituent Assembly by the voters of Paris. He opposed Cavaignac, and in 1849 joined the party of advanced Democrats, of whom he became a leader

and distinguished orator. For his opposition to the "coup d'etat" of December 2, 1851, he was banished.

He retired to the island of Guernsey, where he resided until the fall of the empire, when he returned to Paris. In 1871 he was elected to the National Assembly, but soon resigned his seat and went to Brussels. He was expelled for his sympathy with the Communists there, and returned to Paris. Died May 22, 1885.

Jackson, Thomas J. (Stonewall).

Thomas Jonathan, better known the world over as Stonewall Jackson, an American general, was born in Lewis county, Va., 1824, and graduated at West Point Academy, 1846. After serving with distinction in the Mexican War, he became a professor in the Military Institute at Lexington, Va., until the outbreak of the Civil War. A brigadier-general in the Confederate service at the battle of Bull Run, July 21, 1861, his command on that occasion "stood like a stone wall," to use the words of a distinguished general present.

In September he received the rank of major-general; defeated General Banks at Strasburg, May 23, 1862; fought an indecisive battle with Fremont at Cross Keys, June 8; commanded a corps in the battles of Gaines' Mill, June 27 and Malvern Hill, July 1; again defeated General Banks at Cedar Mountain, August 9; captured Harper's Ferry with 11,000 Federal prisoners, September 15; commanded a corps at Antietam, September 17, and was made lieutenant-general for his services in largely contributing to the National defeat at Fredericksburg, December 13, 1862. On the 2d of May, 1863, by a clever flank movement, he defeated the 11th corps of General Hooker's army at Chancellorsville; and on the evening of the same day was fired at by a patrol party of his own men, who mistook him and his staff, in the darkness, for a detachment of Union cavalry. He died of his wounds on the 10th.

Lincoln, Abraham.

Next to the name of Washington, none stands higher on the roll of illustrious Americans than that of Abraham Lincoln. Indeed, the sixteenth President of the United States, the skilful pilot who guided our ship of state through the stormy period of the great Civil War, is one of the most majestic figures in history. The occasion was great, and he was not only equal to it, but rose above it in such magnificent proportions as to impress the whole civilized world. While he cannot be called the "Father of his Country," he has been denominated its saviour. The tragic close of his life by the hand of an assassin gave him somewhat of the character of a martyr, and has rendered his memory peculiarly sacred.

Mr. Lincoln was born in Hardin county, Kentucky, February 12, 1809. He learned the little that the backwoods schools were capable of teaching, and was employed in rough farm work, until at the age of nineteen he took on a flat-boat a cargo to New Orleans. This was followed later by a second trading voyage, both of which showed the enterprise and self-reliance of the future celebrity. He studied law, removed to Springfield, Illinois, and soon attracted attention as a rising young lawyer of marked ability. He was elected to the State Legislature in 1834, and

served until 1842, having by this time become a leader among the Wigs. In the latter year he was married to Mary Todd, daughter of Robert Todd, of Lexington, Kentucky.

In 1846 Mr. Lincoln was elected to Congress, but his service was limited to a single term. In 1854, Stephen A. Douglass, United States Senator from Illinois, by his Kansas-Nebraska bill, repealed the Missouri compromise of 1820, and reopened the question of slavery in the territories. When the Republican party was organized in 1856 to oppose the extension of slavery, Mr. Lincoln was its most prominent representative in Illinois. A public debate on the political questions of the hour between him and Senator Douglass in 1858, attracted the attention of the whole country and brought out brilliantly Mr. Lincoln's great power in debate, his ready eloquence, his practical common sense, his fund of humor, and placed him among the foremost men of the country, preparing the way for his election to the Presidency in 1860.

He did all that lay in his power to avert the Civil War, but plainly avowed his intention to uphold, according to his oath, the Constitution and administration of the laws of the country. How ably, how wisely, how fearlessly, and with what fidelity to his country's cause he did this, with what charity toward his enemies he carried himself, with what far-sighted wisdom his public measures were promulgated, and how he stood like a massive, immovable tower of strength through the great conflict that rocked our nation, is now a matter of well-known history.

The Federal arms having been victorious after many defeats, and Mr. Lincoln having proved himself to be the master of the situation, he was re-elected by a large popular majority in 1864. In his second inaugural address in March, 1865, he rose above the ordinary range of such occasions, and like an inspired prophet, set forth the profound moral significance of the war he saw drawing to a close. A month later he entered Richmond, from which Grant had driven Davis and Lee.

On the 14th of April, 1865, he was assassinated by J. Wilkes Booth, an actor, and died the next morning. The national rejoicing of the return of peace was turned into grief for the martyred President. The whole civilized world joined in expressions of sorrow for his fate.

Longfellow, Henry Wadsworth.

Our gifted poet, whose works lend an unrivaled charm to American literature, gained a world-wide distinction, and is equally honored at home and abroad. Wherever the English language is the common tongue, Longfellow is read and admired. Surpassed only by Moore in ease and elegance of rhythm, some of his productions have so touched the popular heart that they have become familiar in almost every household. His style is pure and simple, his thought is clear and transparent, while there is an elevation of sentiment which captivates the most cultivated readers. The career of Longfellow began in early life, and was well sustained for a long period of time. He was born in Maine in 1807; was educated in Bowdoin College; was made Professor of Languages in that institution when he was but nineteen years old, and, leaving Bowdoin, accepted a professorship at Harvard.

In 1839 appeared his romance of "Hyperion," and a collection of his poems, entitled, "Voices of the Night," which attracted great attention and raised him at once to the first rank among American poets. In 1841 he published "Ballads and Other Poems;" his charming drama of "The Spanish Student" appeared in 1843. This was followed by his "Poets and Poetry of Europe" (1845), "The Belfry of Bruges and Other Poems" (1846), and "Evangeline" (1847), one of the most admired of all his productions. It has been pronounced (and we think justly) "the most perfect specimen extant of the rhythm and melody of the English hexameter." It was followed by "The Golden Legend" (1851), "The Song of Hiawatha" (1855), perhaps the most popular of all his works; "The Courtship of Miles Standish" (1858), "Flower de Luce" (1866), "New England Tragedies (1868), "The Divine Tragedy" (1872), "Three Books of Song" (1873), "Aftermath" (1874), "The Hanging of the Crane" and "The Masque of Pandora" (1875).

Longfellow resigned his chair at Harvard in 1854, and was succeeded by Lowell. In 1868–69 he traveled in Europe and was everywhere received with marked attention, the degree of D.C.L. being conferred on him by the Universities of both Oxford and Cambridge, England. Mr. Longfellow died at Cambridge, Massachusetts, March 24, 1882.

Lowell, James Russell.

Mr. Lowell's position as an author of both prose and poetry is too well known to need any comment. He has long been ranked with Longfellow, Holmes, Emerson and others, whose achievements have given fame to American literature. While his versification is not so graceful or cultured as that of Longfellow, it exhibits a remarkable strength and force. A vein of humor runs through some of his prose writings as well as some of his poems, and this has added much to their popularity.

Mr. Lowell came from a distinguished family, his father being a minister of the West Church in Boston. He was born in Cambridge, Massachusetts, February 22, 1819, and in his sixteenth year graduated at Harvard College.

He studied law, but never had any serious intention of making that his life pursuit. Perhaps no American writer has exhibited more versatility or has touched upon a wider range of subjects, adorning each with his graceful pen. In 1844 he published a volume of poems, which was followed by a second collection in 1848, and a small volume separately, entitled, "The Vision of Sir Launfal." In the same year he also published his famous "Bigelow Papers," a very witty and caustic satire in the Yankee dialect on the events of the Mexican War.

Having spent a summer in Europe, he returned, and in the winter of 1854–55 delivered in Boston a very popular course of lectures on the British poets. About this time Mr. Longfellow resigned the chair of modern languages at Harvard, and Mr. Lowell was at once appointed his successor. He became the editor of the Atlantic Monthly in 1857, and held this position for five years.

Several volumes of poems were issued subsequent to this time and he also published several volumes of his prose writings, entitled, "Among My Books" and

"My Study Windows." In 1877 he was appointed United States Minister to Spain, and from 1879 until his removal by President Cleveland, in 1885, he was Minister to England. In 1883 he was chosen lord rector of St. Andrew's University, and while in England he received the degree of LL. D. from the Universities of Oxford, Cambridge and Edinburgh. Died August 12, 1891.

Macaulay, Lord.

A great name in modern English literature, and one that is likely to survive for generations to come. In commanding ability, in keen historic insight, in poetical talent, and in the skilful use of the English language, he has few, if any, superiors. His works are classics, and have secured the attention of the most scholarly readers. He distinguished himself in Parliament by his brilliant orations, and also became widely known by his contributions to the Edinburgh Review, which placed him head and shoulders above all other contributors to that famous journal.

Lord Macaulay was born in Leicestershire, October 25, 1800, and was educated at Trinity College, Cambridge, where he won a medal for English verse, obtained a prize for Latin declamation, gained a scholarship and in 1824 was elected to a Fellowship. In 1826 he was called to the bar, but made no attempt to secure a practice, his tastes inclining him to politics and literary pursuits. His poems, most of which commemorate historic events, exhibit in a high degree the art of word painting and are full of virile energy.

His best known work is his "History of England," which shows great research and is written in the most attractive style. He was devoted to his family, who were in humble circumstances, and was a most affectionate son and brother. He died in 1859, and was buried in Westminster Abbey.

McKinley, William.

The highest distinction that can be conferred by our country was bestowed upon this American statesman, who was born at Niles, Ohio, February 26, 1844. He enlisted in the United States army, in May, 1861, as a private soldier in the 23d Ohio Volunteer Infantry, and was mustered out as captain of the same regiment and brevet-major in September, 1865. He was prosecuting attorney of Stark county, Ohio, 1869-71. Being elected to Congress in 1877, he lost his seat through some technicalities in the election by vote of the House in 1884, but was re-elected and sat continuously as a member of Congress from 1885 to March 4, 1891.

He became famous as the author of the protective tariff bill passed by Congress in 1890, a measure which was largely modified by Mr. Cleveland's administration, but the wisdom of which has been claimed by Mr. McKinley and his party as being fully vindicated. In 1896 he was nominated with great enthusiasm for the Presidency by the Republican party, and was elected in November of that year by an immense popular majority. In his conduct of the Spanish-American War and his treatment of all the difficult questions arising from time to time, his course has been approved by a large majority of his countrymen and his fame as an orator and statesman has been established. He died at the hands of an assassin, September 14, 1901.

Moody, Dwight Lyman.

This celebrated American evangelist was born at Northfield, Mass., January 5, 1837. He came of poor parentage and was deprived of educational advantages in his boyhood. For a while he was a salesman in Boston, and in 1856 went to Chicago, where he engaged with remarkable success in missionary work. In 1870 he was joined by the well known singer, Ira D. Sankey, who was born at Edinburg, Pa., in 1840.

In 1873 they visited Great Britain as evangelists, attracting vast crowds and laboring with phenomenal success. They afterwards returned to America and worked together in all the large towns, awakening great enthusiasm among the churches and exerting an influence such as had never been known before in evangelistic work. Mr. Moody probably addressed a larger number of people than any preacher of modern or ancient times, his audiences ranging from 5000 to 20,000 and upwards.

Possessed of a strong physique, a hearty genial manner, a voice of great penetration and power, a fluent utterance, a simplicity necessitated by his lack of education, but which added greatly to the effect of his discourses, he was for nearly forty years the most conspicuous figure in religious work.

At his home in Northfield, Mass., Mr. Moody planted schools for the education of both sexes, raised hundreds of thousands of dollars to establish and equip them, and left them as a monument to his liberal spirit, his great financial ability and his untiring energy in his labors for the welfare of others. Mr. Moody died in December, 1899, and Christian people throughout the civilized world expressed their sense of bereavement, and with glowing eulogies honored the man and his work.

Payne, John Howard.

Author of "Home Sweet Home," which was written while he was United States Consul at Tunis, where he died in 1852. He was born in New York in 1792, and in early life was an actor in American cities and in London. His remains now repose at Washington, D. C., where a splendid monument, the gift of Mr. Corcoran, the banker, has been erected to the memory of the author of our sweetest American song.

Poe, Edgar Allen.

An American poet whose most celebrated poem, "The Raven," holds first rank in our poetical literature. Poe's genius is universally acknowledged. His writings bear in every line the stamp of originality; his conceptions are unique, and his style of versification is peculiarly his own. He was of nervous temperament, unfortunate in some of his habits, the victim of adversity, and his life has been the subject of much criticism, while his works have been universally admired.

He graduated at the University of Virginia in 1826, and in the next few years was editor of several magazines that were popular in their day. Among his prose works, "The Gold Bug" is well known, but his poems have gained the wider circle of readers and admirers. "The Raven," already mentioned, and "The Bells" have made their author noted. Born in Boston, Mass., in 1811, and died in Baltimore, Md., in 1849, of delirium tremens.

Riley, James Whitcomb.

"The Hoosier Poet of America," was born in Greenfield, Indiana, in 1852. Over an assumed name, he began to contribute verses in the Hoosier dialect, to the Indianapolis papers in about 1875, which attracted considerable attention. Since then his productions have been widely read. They are characterized by a rich vein of humor, as well as pathos, and their setting in dialect gives them additional charm and interest.

Saxe, John Godfrey.

He excelled especially as a humorous poet, and many of his pieces have become familiar to the reading public. When he began to write he struck out into a new field and his venture was most successful. Mr. Saxe was born in Franklin county, Vermont, in 1816. He graduated from Middlebury College, Vermont, in 1839, and subsequently became editor of the Burlington Sentinel. He was elected State's attorney in 1851. A collection of his poems appeared in 1849. They rank among the most successful productions of their kind, and have obtained extensive popularity. A new edition of his collected poems was published in 1864. He produced in 1866 "The Masquerade, and Other Poems," and "Leisure Day Rhymes" in 1875. Died March 31, 1887.

Talmage, Thomas DeWitt.

This widely-known clergyman was born in New Jersey, in 1832, and graduated at the University of the City of New York in 1853. After holding various Dutch Reform pastorates he settled over a Presbyterian church in Brooklyn in 1869. Having been deprived by fire of his Tabernacle on two different occasions, he removed to Washington in 1895. He has published several volumes of sermons and other works of a miscellaneous character. His style was graphic and often humorous, and his attractiveness as a public speaker drew crowds of hearers. In 1899 he retired from his church in Washington and devoted himself to literary work. He died April 12, 1902.

Tennyson, Alfred.

For many years Lord Tennyson was without a living peer as a poet. It has been even said that no writer since the days of Shakespeare has exhibited such wonderful power of clothing poetic thought in captivating language. His poems are nothing less than creations, many of them sublime beyond comparison, and exhibiting the severest culture and most painstaking effort.

Tennyson was born in 1809 and was educated at Trinity College, Cambridge, where, in 1829, he obtained a prize medal for a poem in blank verse on "Timbuctoo." Soon after he published "The Lady of Shalott," "The May Queen," "The Lotus Eaters," "A Dream of Fair Women," etc., etc. In 1849 he issued anonymously "In Memoriam," which many persons consider the finest of all his productions. Many of its remarkable couplets and stanzas have passed into the common speech of our time and have become favorites of thoughtful persons, and even of those religiously inclined.

Tennyson's fame grew through all his long life, and it is noteworthy that each new production appeared to increase his reputation and gave him a stronger hold upon the affections of the reading public.

More abrupt, more vigorous in thought, more rugged and massive as a poet than Longfellow, his versification was yet easy and graceful, although inferior in this respect to that of our own great poet, just mentioned, whose name is a household word everywhere. Tennyson died October 6, 1892.

Mark Twain (S. L. Clemens).

Under the *nom de plume* of Mark Twain an author appeared about 1867, whose quaint humor attracted immediate attention and soon gained a large circle of readers. There was a flavor of the western prairies about his productions and such odd conceits as marked him at once as a humorist of the first order.

Probably his best known work is "Innocents Abroad," which gave him considerable reputation. This was followed by "Roughing It," "Tom Sawyer," "Huckleberry Finn," and other volumes, all of which have been well received by all classes of readers. His ability in his chosen field is unsurpassed. He was a member of the firm that published the Personal Memoirs of President Grant. Mr. Clemens was born in the town of Florida, Mo., in 1835.

Stowe, Harriet Beecher.

This distinguished American authoress was born at Litchfield, Conn., on the 14th of June, 1812. She was the third daughter and sixth child of the celebrated Dr. Lyman Beecher. In early life she exhibited literary taste and gained distinction as a graceful writer.

In 1836 she was married to Professor Calvin E. Stowe. In 1850 she went to Brunswick, Maine, where her husband had been appointed Professor of Bowdoin College. While here she wrote "Uncle Tom's Cabin," and furnished it to the National Era (published at Washington) in weekly contributions. The success of this work has been without a parallel in the history of literature, its sale having gone up into the millions here and in Europe, where it has been translated into a number of different languages. When this remarkable story appeared the public mind in America was much agitated, and there can be no doubt that Mrs. Stowe's work hastened the great crisis that resulted in the Civil War and the destruction of the institution of slavery.

Mrs. Stowe was the author of other works that had great popularity, including "Sunny Memories of Foreign Lands," "Dred, a Tale of the Dismal Swamp," "The Minister's Wooing," "Oldtown Folks," etc. She wrote the "True Story of Lord Byron's Life," published in this country and in England. This work was severely criticised, and brought down upon the devoted head of the authoress a storm of indignation. Mrs. Stowe has written other works of great merit, and it may safely be said that no authoress of modern times in any country has achieved a greater success. She died July 1, 1896.

Scott, Sir Walter.

The very name of Sir Walter Scott strikes a responsive chord in almost every breast, for few are the persons who have not been charmed and delighted with the "Waverly Novels" and his sprightly, spirited poems. His name is the chief ornament of Scottish literature, and such is the character of his works that they can

perish only with the language. In accuracy of historic description, in throwing over his writings an air of charming romance, in skilful weaving of the plot, and in photographing the various characters so that the reader almost imagines he sees them before his eyes, Scott may be said to be without a rival. His works have had a phenomenal popularity.

He was born in Edinburgh, 1771. Of delicate health in early life, he slowly advanced to a sturdy manhood, and became distinguished as an author at a period comparatively late. Perhaps no other author wrote so much when past the age of fifty-five. It is honorable to the memory of Scott that a large amount of his literary work was undertaken and carried forward for the purpose of meeting a pecuniary obligation. "Waverly" took the world by storm, and Scott, who did not acknowledge the authorship, might well suppose he had found the pot of gold at the end of the rainbow.

As a writer, it is a truism to say that, since Shakespeare, whom he resembled in many ways, there has never been a genius so human and creative, so rich in humor, sympathy, poetry, so fertile in the production of new and real characters, as the genius of Walter Scott. "The Lay of the Last Minstrel" and "The Lady of the Lake" hold high rank in the realm of poetry, and are full of life and spirit. They are colored by the romance of Scottish history and Scottish scenery. For a long time Scott resided at Abbotsford, a few miles from Edinburgh, which was one of the famous places to visit by all tourists in Scotland. He died in 1832.

Warner, Charles Dudley.

One of our most popular American authors, born in Massachusetts in 1829, and educated at Hamilton College, New York. He studied law, and in 1857 was admitted to the Philadelphia Bar, but afterwards became a journalist at Hartford, Conn. "My Summer in a Garden," "Black Log Studies," "My Winter on the Nile," and "Being a Boy," are among his best known works. In connection with Mark Twain he produced "The Gilded Age," a novel and play. He also compiled a valuable libraryof English literature, published in upward of forty volumes. His writings have a genuine humor and abound in graphic descriptions. Died October 20, 1900.

Webster, Daniel.

One of America's most distinguished statesmen and orators, whose intellectual and oratorical triumphs at the bar and in the forum were long the pride of his country. He had warm political friends and bitter enemies. The latter accused him of a time-serving spirit, and an unscrupulous ambition to obtain the Presidency. His literary style is pure and elevated, and all his writings, including his political speeches, bear the stamp of the highest order of political genius.

Mr. Webster was born at Salisbury, New Hampshire, and was educated at Dartmouth College. He studied law, rose rapidly in his profession and was soon regarded as a fit antagonist for Jeremiah Mason, who was regarded as the greatest lawyer in the State, and was many years older than Webster. He was elected a Representative in Congress and took his seat in 1813. Here he distin-

guished himself by his legal acumen, his commanding presence and powerful eloquence.

He continued to serve in the House of Representatives until 1828, when he was made United States Senator, representing Massachusetts. He gained great fame by a number of public addresses on important occasions, such as the celebration of the landing of the Pilgrims, the dedication of Bunker Hill Monument, etc., while his memorable reply in Congress to Hayne, of South Carolina, ranked him as an orator without a peer. It was in this speech that he uttered the famous words, "Liberty and Union, now and forever, one and inseparable."

Mr. Webster was accused by his opponents of being over ambitious to obtain the Presidency, and of truckling to the slave power in the endeavor to obtain a nomination for that high office. Be that as it may, he did not succeed, and after a career whose brilliancy, all things considered, has scarcely been equaled in modern times, he died in 1852 at Marshfield, Mass., leaving behind him a great name in our country's annals.

Willard, Frances E.

One of our most distinguished American women is the subject of this sketch. No one was more widely known or universally respected. She possessed talents of an unusual order, a warm and earnest spirit, untiring energy, the ability to influence others, and seemed to be lacking in none of those qualities essential to successful achievements. She was an orator of the first rank, and therefore deserves an honored place among the conspicuous names that stand out on these pages.

Miss Willard was born in Churchville, N. Y., September 28, 1839, and was educated at Milwaukee and the Northwestern Female College, at Evanston, Ill., from which she graduated in 1859. She became Professor of Natural Sciences there in 1862, and was Principal of Genesee Wesleyan Seminary in 1866–67. She was known throughout the country for her devotion to the cause of reform, especially that branch of it embraced in temperance work.

In 1874 she gave up all other engagemests to identify herself with the Woman's Christian Temperance Union, and was immediately made corresponding secretary, discharging the duties of this office until 1879, when she was elevated from the position of secretary to that of president. In 1876 she assisted Dwight L. Moody in his evangelistic work, and rendered efficient service. She organized the Home Protection movement, and sent an appeal from nearly 200,000 people to the Legislature of Illinois, asking the temperance ballot for women. In 1888 she was made president of the American Branch of the International Council of Women and the World's Christian Union. In 1892 she visited England and received an enthusiastic welcome from the friends of reform in that country. She was at the head of the Women's Committee of Temperance Meetings at the World's Fair in 1893.

Miss Willard was one of the most celebrated women of the century, a renowned leader, whose name will long be honored, not only by her own sex, but by everybody. She died in New York, February 18, 1898, sincerely mourned by thousands in all parts of our country.

THE PANAMA CANAL.

THE eyes of the whole world are centered on the narrow strip of land connecting the northern and southern sections of the Western Hemisphere, and named on the maps Panama.

There is at last the assurance that the long deferred enterprise of cutting across this strip of land a ship canal connecting two great oceans is soon to be completed. The obstacles to this great project having disappeared.

The treaty between the new Republic of Panama and the United States and the enactment of the legislation by the latter necessary to commence the work of construction terminated all contention over the relative value of routes, concessions, policies, etc., which have stood in the way of the construction of an isthmian canal for many years, and opens the way for a vigorous prosecution of the great maritime enterprise.

"No work that remains to be undertaken on this continent," said President Roosevelt in a message to Congress, "is of such great consequence to the American people as the building of a canal across the Isthmus connecting North and South America. It is emphatically a work which it is for the interest of the whole world to begin and complete as soon as possible. It is one of those great works which only a nation can undertake with prospects of success, and which when done are not only permanent assets in the nation's material interests, but standing monuments to its constructive ability."

S. L. K.

As early as 1827 the use of the Isthmus for commercial transit was discussed and steps taken to secure that end. In that year President Bolivar gave a commission to J. A. Lloyd to survey the Isthmus of Panama in order to ascertain the most eligible line of communication across it, whether by road or canal. Nothing came of this commission beyond making surveys and formulating a report in which a new line of travel across the Isthmus was recommended. In 1838 the Republic of Colombia made a grant to a French company authorizing the construction of macadamized roads, railroads and canals across the Isthmus, with the Pacific terminus at Panama.

Several years were spent in explorations, and reports were made which encouraged that undertaking, and it was decided to make further investigation, with a view of cutting through the Isthmus to join the two oceans by a canal. An elaborate report was the result of this investigation by Napoleon Garela, who recommended the construction of a canal, but nothing was done.

Events that occurred about the middle of the last century made it clear to sagacious statesmen that a maritime connection between the two oceans at the Isthmus of Panama was of the very highest importance to the United States. The dispute with Great Britain as to the boundary line west of the Rocky Mountains was settled by the treaty of 1846, and Oregon became an organized territory in 1848.

By the treaty of Gaudalupe-Hidalgo, in 1848, following the war with Mexico, California was ceded to the United States. The discovery of gold in that State induced many thousands of people of this country to seek the mining regions, and to avoid the hardships of travel across the plains, lines of steamships were established between New York and San Juan del Norte and San Francisco and Panama.

This stream of travel led to the construction of a railroad across the Isthmus, and was the means of attracting general attention to the value and importance of communication by that route, and gave fresh interest to the question of constructing a canal. The matter was taken up by Congress and a report made, in 1849, by a committee recommending surveys from points on the Gulf of Mexico to the Pacific Ocean.

Nothing came from this investigation in the way of promoting a canal, but it may be said that the construction of the railroad was the result. On the completion of the road appropriations were made by Congress for carrying the mails across the Isthmus. Various efforts followed to secure concessions from New Granada and Nicaragua for citizens of the United States to construct a canal, some of which were successful, but none of which accomplished anything practical.

The French Company.

In 1878, the Colombian Government made a concession to a provisional company formed in France, for a period of ninety-nine years, for the construction of a canal across its territory, and this concession was subsequently transferred to the Panama Canal Company, which undertook the work of construction, but failed and went into liquidation. Ferdinand de Lesseps was President of this company.

Following the failure of De Lesseps, a new organization was perfected, and the work of construction was continued merely to preserve the concession, in the hope that the property and concession would be purchased by the United States. The price at which the property was offered was so large that the Walker Commission, which had investigated the general question, recommended the Nicaragua route; but subsequently the Panama Company offered the entire property for $40,000,000, and the property was taken by the United States at those figures.

It is estimated that the completion of the canal will cost $144,000,000, and if the money to be paid the Panama Company and the Republic of Panama be added, it will be seen that the cost of this work to complete will be at least $200,000,000, and may reach $225,000,000.

Length of the Canal.

The total length of the canal will be 49 09 miles. This includes seven miles of free sailing on Lake Bokio. The length of the Nicaragua route is 183.66 miles, including 42 miles of free sailing on Lake Nicaragua. Thus it will be seen that there is in favor of the Panama route 100 miles of canal navigation. It is estimated that a vessel would be three times longer in going through a canal by Nicaragua than by the Panama route.

Aside from the value of the canal to the United States, from a military point of view, it will prove of great value to the industrial and commercial interests of all parts of the world. The expense and delay now incurred in commercial intercourse between the Atlantic and

Pacific sections of the United States and in the trade between the Pacific States with Europe impose a serious limitation upon the progress of our industries.

Cheaper and more expeditious access to the Pacific markets will benefit not only the Eastern States by furnishing cheaper raw materials and larger markets for their industrial products, and the Southern States by increasing their exports of cotton and its manufactures, forest products, iron and steel manufactures, but also the Central West, which is now manufacturing extensively for the foreign and domestic trade.

The canal will benefit all these sections by furnishing a larger business with the Pacific coast, and enhance their ability to compete with Europe in Western South America and the Orient. It will place Europe and the United States on a basis of equality in distance for the trade of the Far East and Australia, the advantages at present being greatly in favor of Europe.

Market for Coal.

The report of the Walker Commission points out that the canal will have an especially direct and important effect upon the market for American coal. Vessels engaged in our own or European commerce through the canal will find it to their advantage to purchase American fuel on our Atlantic or Gulf seaboards, or in West Indian and Central American stations. The larger commerce which the canal will cause to move across the North Pacific may increase the demand for the product of the Puget Sound mines.

The low cost at which coal can be placed at tidewater on the Gulf and Atlantic seaboards, and the fact that there will be a considerable movement of vessels in ballast or with part cargoes westward through the canal, makes it probable that the coal required for industrial purposes on the west coast of South and Central America, and for commercial uses in those regions, and to some extent in the coaling stations of the Pacific, will be supplied from the mines in the southern and eastern sections of the United States. The demands at home for the coal of all the mining centres of the United States will be enlarged by the canal in proportion to its effect upon the development of American industries.

The effect of the canal upon the railroads in the eastern and southern sections of the United States will be favorable. The lines in the central West will feel the competition in rates somewhat more than will the Eastern and Southern roads, but the only business that can be diverted from them is the low-class trans-continental traffic, and this will be fully compensated for by the larger traffic due to the canal's effect upon the development and diversification of the manufacturing and other industries of the section they serve. The railways connecting the Mississippi Valley with the Pacific ports are the roads with which the canal's competition will be strongest, and the rates on a large share of their through business will be regulated by the water route.

Time of Completion.

It is calculated that the canal will be completed in ten years, or in the year 1914. From an examination of statistics of vessel movements between the Atlantic and Pacific it is estimated that nearly 7,000,000 net tons will pass through the canal in 1915. Assuming that the rate of increase in traffic during the first ten years of operation would be 62½ per cent., the tonnage that would pass through the canal in 1925

would be raised to approximately 10,500,000 net tons. At the rate of $1 per net ton of register, the income from the canal would be in 1915 about $7,000,000, and in 1925 about $10,500,000. The annual cost of operation, it is estimated, will be $2,000,000.

The extent to which the canal will be used will depend largely on the rate of tolls charged. Light charges will give the Panama Canal a large part of the trade that now goes by the Suez Canal from the Atlantic ports to the Philippines and the East. The tolls by the Suez route are more than $2 per ton. The Suez tolls are levied by a corporation, whose object is to secure the maximum of revenue. In fixing the charges for the use of an Isthmian canal owned and operated by the United States Government, the principle of maximum revenue could not be wisely followed.

The revenue producing functions of the canal will be minor as compared with its services in promoting the industrial and commercial progress and general welfare of the United States. The exaction of tolls that would much restrict the benefits derivable from the canal would not be to the advantage of the people of this country. Regarding the relative advantages to be derived by Europe and the United States, the report of the commission says:

Benefits of the Enterprise.

"As compared with Europe, the United States will derive from the canal greater benefits, both commercially and industrially. The commerce of Europe with the Pacific coast of North, Central and South America, under existing conditions, is about as large as the total volume of the present traffic of the United States that may be considered tributary to the canal; but this fact does not indicate the relative advantages which the canal will possess for the trade of Europe and that of the United States.

"As soon as opened, our trade with the west coast of South America will increase more rapidly, as will also our trade with the Orient. An Isthmian canal will strengthen the unity of the national and political interests of the United States, develop its Pacific territory and promote the commerce and industries of the entire country. The benefits which Europe will derive from the canal will be commercial. In addition to this, ours will be political and industrial."

A great commercial waterway, costing this Government not less than $200,000,000, to be finished in ten years' time, will be the result of diplomacy and legislation. In this project the nations of both hemispheres are in full accord with the United States, and Germany has gone so far as to declare, unofficially of course, that it stands ready to congratulate America "the day the first ship passes through the Panama canal."

The United States will build the canal and control it in conjunction with the State of Panama. When the great scheme is finished, vessels from the Atlantic coast to Hawaii, to China, to the Philippines, to Japan, will save the long trip of the Suez Canal or around South America.

Value in War Times.

Modern needs advance with the progress of modern times. The need of a waterway at the foot of North America, which will make it an island, has pressed harder as the years have gone on. The Oregon's long trip during the Spanish-American war furnished a significant lesson on the need of a canal across the Isthmus. Captain

Clark had to make a run of nearly 14,000 miles by way of Cape Horn, whereas by cutting through the Isthmus, the distance would have been reduced to about 5,000, a saving of 9,000 miles in the trip. Naval experts are unanimous in declaring that work must be begun at once, that delay is dangerous when the American navy is small as compared with those of other nations.

The State of Panama was formerly a component part of the Republic of Colombia. The revolution of the residents, their declaration of independence of Colombia, and the treaty with the United States of America are matters of history. The United States of America by treaty guarantees the independence of Panama, and will also obtain the right to construct a canal that will be open to the commerce of the world.

Millions Have Been Squandered.

The Panama Canal is not a new thing. It has been the cause of one of the world's greatest scandals, and millions of dollars have been sunk in the wilds of the Isthmus.

It will be a surprise to many to know that the Panama route was surveyed by Commander Lull in 1875, that he recommended the construction of a 26 foot canal with a summit-level of 124 feet above mean tide level, and that this route was located very much on the same route as that adopted by the present Isthmian Canal Commission. He estimated the cost of this canal at $94,511,360.

In 1879 an International Congress met in Paris and recommended the building of a sea level canal from Colon, on the Atlantic, to Panama, on the Pacific, the work to be completed in twelve years at a cost of $240,000,000. Work was begun in 1881. An enormous amount of plant was purchased, 15,000 laborers were imported, and with the most incomplete data to work upon, the De Lesseps people, already referred to, rushed into the most stupendous engineering undertaking of the age. Yellow fever, floods, incompetence, unparalleled fraud and dishonesty, coupled with the impossible nature of the undertaking itself, soon brought about the inevitable disaster, and in 1889 a receiver was appointed, who found that securities to the amount of $435,000,000 had been issued, and $246,000,000 had been squandered.

In 1894 a new company was formed for the purpose of completing the canal. They determined to abandon the scheme for a tide level canal and, instead, adopted a plan for a canal 29½ feet deep, with a summit level of 98 feet, a second level of 68 feet, and a third 33 feet above the sea. The Chagres River was to be controlled by means of a dam at Bohio, forming a navigable lake in the valley of the Chagres, another dam further up the Chagres River, which was to supply water to the summit level. An International Technical Commission of Engineers examined the plans of the new company and pronounced them perfectly feasible, the estimated cost of completing the canal being set down at $102,400,000.

Our Own Canal Commission.

Our own Isthmian Canal Commission proposed a 35-foot canal, with 90-foot summit level and three locks, which they estimate can be built for $144,233,358.

The French company has done considerable work upon the canal, but their labors have scarcely made an impression upon the mountains and other deep cuts that will prove to be so expensive. The company completed about fifteen miles of the

canal in sections, where most of the work will have to be done over again.

The immense difficulties of constructing the canal will appear when we examine the work in detail.

The physical difficulties consist of the Culebra cut through the continental divide near the Pacific, and the floods of the Chagres River, which latter flows down from the northeast, intercepts the line of the canal at about its centre, and coincides more or less with the general route of the canal from the point of interception to its Atlantic terminus. The problem is to be solved by cutting a tide level canal for the first 16 miles from the Atlantic to Bohio, where a dam will be thrown across the Chagres River, the dam to be of sufficient height to form a great lake in the valley of the Chagres, whose maximum elevation will be 90 feet above mean sea level.

How the Work Was Done.

Allowing for the greatest possible variation due to heavy continued rains and freshets, the level of the lake will be maintained between the extremes of 82 feet as a minimum and 90 feet as a maximum level above the sea at mean tide. The surplus waters of the rainy season will be discharged over a weir 2000 feet in length, which will be built not far from the Bohio dam, the waste waters being conducted to the Atlantic partly by the Chagres River and partly by artificial channels.

At Bohio will be located a double lift lock with a total maximum lift of 90 feet. The line of the canal traverses the Bohio Lake thus formed for a distance of about 14 miles, or until it reaches Obispo, where there will be placed a set of gates 100 feet wide, the purpose of the gates being merely to retain the waters of Lake Bohio should it at any time be desirable to drain off the waters of that portion of the summit level lying beyond the gates.

Passing through the gates the canal enters the Culebra section, which consists of a great cut through the continental divide. This section is about 8 miles in length, and at the Pacific end of it are the Pedro-Miguel locks. Then follows a level of 1.33 miles in length, which leads to the Miraflores locks, by which descent is made to the tide level on the Pacific. From the Miraflores locks to the 6 fathom line on the Pacific is a distance of 8.5 miles.

Cost of the Work.

The total cost of completing Panama is estimated at $144,233,358, while the total cost of building Nicaragua is estimated at $189,864,062. The Panama Company, however, offered to sell their properties at the price named by our Commission, $40,000,000, thus making the cost of the completed Panama Canal $184,233,358. This renders the completed Panama Canal cheaper by $5,630,704 at first cost.

The Commission, however, says it will cost $1,300,000 more every year to maintain and operate Nicaragua than it will Panama. This sum capitalized at 4 per cent. and added to the cost of constructing Nicaragua, makes the Panama Canal considered as a financial proposition, over $38,000,000 cheaper in the long run than the Nicaragua Canal.

From Bohio to the Obispo gates the Panama Railroad must be rebuilt for 15.5 miles on a new location, with a bridge across the Chagres below Gamboa. An estimate made from approximate profiles indicates that the cost of this diversion will not exceed $75,000 a mile, or $1,162,500. From the Obispo gates the railroad will be carried for 6 miles on the bench formed by

the retaining wall on the east side of the Culebra cut, these 6 miles being estimated to cost $10,000 a mile, which includes only track laying, ties and ballasting. Beyond this will be a mile of light work estimated at $25,000, while the main track will have to be raised for 2 miles further at a cost of $20,000. Combining these figures, the total cost of the diversion of the Panama Railroad becomes $1,267,500.

Time to Pass Through.

The time required to pass through the canal after completion will vary with the size of the vessel and with the number of other vessels. For the purpose of comparison the time has been carefully computed for a ship 400 feet long, 50 feet beam and 24.5 feet draft, or what may be called an average sized ship. The open sea speed is taken at 12.5 statute miles, or about 11 knots per hour. The reduced speed in various parts of the canal and the delays caused by lockages and by passing other vessels have been obtained from observation of the practical working of the Sault Ste. Marie and the Manchester canals.

They are as follows: In canal sections having a bottom width of 150 feet, speed on tangents 8 miles per hour, on curves 7 miles per hour; in Panama Bay channel, speed 9 miles per hour; in Lake Bohio, speed on tangents 10 miles per hour, on curves 9 miles per hour; in harbors and harbor entrances, speed on tangents 10 miles per hour, on curves 8½ miles per hour; all statute miles. The delay caused by lockages is 3 hours and 58 minutes, and that caused by meeting other vessels, 1 hour and 14 minutes. From these data the time of transit through the canal is computed to be 11 hours and 14 minutes.

The territory of Panama, embracing the larger part of the Isthmus, extends east and west about 460 miles measured in a straight line. It adjoins the Republic of Costa Rica on the west. Panama and Costa Rica have a long standing boundary dispute, and no one pretends to know how it will finally be decided. Near the boundary on the Caribbean side is Bocas del Toro, the fine inlet protected by islands. The eastern boundary is the Gulf of Darien and the Atrato River, which is navigable almost to its source in northwestern Colombia. The river would not be prominent in any hostilities that Colombia might contemplate, because muddy bars at its mouth prevent entrance to any but the smallest vessels; and to take troops down the Atrato to Panama would involve the crossing of almost impassable mountain ranges.

The hills that cover most of the Department of Panama are connected neither with the Andes in the east nor with the North American Cordilleras in the west. The Andes end to the east of the Atrato River, which limits Panama to the east. The high central divide of Costa Rica extends only a little way into the western end of Panama; and further east is the Cordillera of San Blas, which is not a central range, but a marginal accompaniment of the Atlantic border. With these two exceptions, there is no indication of systematic arrangement among the innumerable hills and low mountains which cover nearly the whole of the Isthmus. There is, therefore, no valley leading from the ends of the Isthmus to the neighborhood of Panama and Colon.

Mountains and Rivers.

The low mountains and hills are sprinkled with the greatest irregularity all over the country. They are due to erosion, brought about by the immense

precipitation of the Isthmian region. The streams flowing around their flanks are subdivided to a remarkable extent, and only a few of them are navigable, with difficulty, for short distances.

From the banks of these streams to the tops of the hills and mountains on which they abut is found everywhere, except in one region, a dense and almost impenetrable jungle of vegetation, consisting of grasses, sedges, wild plantain and trees characteristic of the Caribbean coasts. This is the reason why our knowledge of the interior of the narrow Isthmus is still deficient; why a large area west of the Gulf of Panama and another west of the Atrato River are white on the large scale map compiled by Hill in 1896 and marked "unexplored"; why the little basin of the Chagres River was not surveyed till our last commission went to Panama; why parties exploring in the interests of the several canal projects have followed stream valleys from either coast and turned back defeated at the water partings between the Atlantic and Pacific drainage basins.

The exception above mentioned to the otherwise universally prevalent jungle is confined to a few small and widely separated areas of approximately level, treeless upland near the Pacific coast, and extending from the Gulf of Panama to Costa Rica. The various towns and hamlets of Panama are situated on these uplands near the Pacific, or scattered thinly along both coasts, or dotted along the line of the railroad between the two chief ports.

The interior is a tropical, jungle covered waste, inhabited only by the remnants of Indian tribes, some of which have almost disappeared; without resources to feed a party of explorers, to say nothing of an army; without even continuous paths as means of communication.

Nata is one of the oldest settlements in Ameriea, dating from 1512, some time before the name of Mexico was known in Europe.

The city of Panama owes all its celebrity to its vital position at the narrowest part of the Isthmus. It has flourished or declined according to the routes followed by international trade.

Under the old regime of Spain the only line of communication between the two oceans was one simple mule path crossing the Isthmus from Panama to Porto Bello on the Atlantic side. Porto Bello harbor is commodious and deep, but the fortifications of the old seaport are now overgrown with forest vegetation and the place has become an obscure hamlet occupied by a few hundred negroes who do a little trade with Colon, Colombia and Jamaica. The deadly Chagres fever raged so there that the port was practically abandoned and Chagres became the Atlantic terminus of the Isthmian route from Panama. But Chagres soon won fame as a hot bed of marsh fevers and the population rapidly disappeared.

A new port was founded, therefore, which was called Colon in honor of Columbus, who discovered the bay. It became known also as Aspinwall, from the name of one of the chief promoters of the Isthmian railroad. This name, in late years, has been very little used.

Panama, the chief city, is the capital of the State of Panama, situated on the south coast, on a bay of the same name. The harbor is well protected, but shallow, so that large vessels can not come nearer shore. It became an important place on account of the Panama railroad, of which it is the Pacific terminus.

THE LOUISIANA PURCHASE.

THE Centennial Anniversary of what is known as the Louisiana Purchase was celebrated in 1904, by a great World's Fair at St. Louis, in which nearly all civilized nations were represented. The preparations for this event, which were made on a vast scale and at great expense, resulted in an exhibition that showed our country's progress up to date, and eclipsed all previous exposition of a similar character.

The Louisiana Purchase is one of the crowning events of our country's history. Without the force of arms, without a battle or the firing of a gun, this important transaction took place, which not only added another territory to the United States nearly equal in size to that already possessed, but has had a direct influence upon the destinies of mankind.

National expansion; our nation dominant from ocean to ocean and "Old Glory" floating on every breeze from the Atlantic to the Pacific; room for hundreds of millions of people to try their fortunes in the New World; colossal wealth in vast prairies whose rich products fill the granaries of the world; myriad outlets for capital and business enterprises; institutions of every description for the well-being of humanity—all this was meant by the grand and peaceful purchase that extended our territory to the limits of the Continent.

President Jefferson and Napoleon Bonaparte were the chief actors in the purchase and transfer of Louisiana and its immense territory. Both were men of far-sighted vision, the one a statesman of whom our country has just occasion to be proud, and the other a miracle of military genius and prowess at whose word all Europe trembled; yet it is doubtful if either grasped the full magnitude of the situation or even dreamed of the vast consequences of their united act. Jefferson was a master builder, but he was "building even better than he knew."

By this purchase, another magnificent Republic was added to our already vast domain. Mighty rivers, rolling to the sea, float the commerce of this immense region; railroads are crowded with its enormous traffic; millions of farms and thrifty homes have replaced the wilderness; villages and bustling cities have sprung up as if by magic; schools, churches, banks and factories greet the amazed traveler on every side. By the Louisiana Purchase, the "Star of Empire," traveling westward, burst into new and brighter splendors.

When our country became a sovereign, free and independent nation, our territory nowhere touched the Gulf of Mexico, nor was our flag anywhere to be seen beyond the Mississippi river. Spain owned the great west and the island on which stood New Orleans, and had just obtained from Great Britain a retrocession of Florida and all the territory south of thirty-first degree of north latitude. But Spain claimed more, and during sixteen years held armed possession of much of the present States of Alabama and Mississippi;

displayed her flag and maintained her garrisons on many a bluff as far up the Mississippi as Tennessee, and closed the Father of Waters to navigation by citizens of the United States.

Not till 1795, when we made our first treaty with Spain, did we obtain from her a recognition of the thirty-first degree of latitude as part of our southern boundary, a promise to withdraw her garrisons north of that line (which was not done till 1799), and a right to deposit goods at New Orleans for exportation.

To our forefathers these concessions seemed little enough. The treaty acknowledged the validity of a boundary line given us at a time when Great Britain owned the territory to the north and to the south of it. The treaty provided for the removal of armed forces from a country where they had no right to be, and granted to a friendly nation the commercial use of a river, one bank of which it owned from the source almost to the mouth. Yet, mild and local as were its provisions, they set in motion a train of events which in eight years brought us the vast domain known as Louisiana.

Talleyrand's Hostility.

That Spain should be short-sighted enough to make such concessions astonished and alarmed Talleyrand, who then served the French Directory as Minister of Foreign Affairs. "The United States," he said to a Minister he was about to dispatch to Madrid, "have been put in possession of the forts along the Mississippi." It was essential that Spain should hold these forts in order to stop the progress of the Americans. They were determined to rule America.

The only way to put an end to this ambition was to shut them up within the limits which nature seemed to have traced for them. But Spain was in no condition to do this great work. She would do well, therefore, to cede to France East and West Florida and Louisiana, and "from that moment the power of America is bounded by such limits as it may suit the interests of France and Spain to assign her."

The French Minister at the Court of Madrid was accordingly instructed to seek for a cession to France of the territory in question; but ere the scheme was carried out Talleyrand fell from power, the Directory was overthrown, Napoleon returned from Egypt and by his coupe d'etat made himself master of France.

Once safely established as First Consul, Napoleon recalled Talleyrand to his old post of Minister of Foreign Affairs, and then negotiations for the retrocession of Louisiana went rapidly forward. So rapidly, indeed, that on the 1st of October, 1800, at San Ildefonso, Charles of Spain signed a secret treaty which bound him to return to Napoleon the Louisiana which, in 1763, France had given to Spain.

Events That Are Historic.

Talleyrand had triumphed. The Americans were now to be shut up within the limits which nature had traced for them; their ambition was to be checked, and such bounds as pleased France and Spain were to be set to their power. All this seemed certain to happen, yet none of it was ever to come about. How news of the secret treaty leaked out and came to the knowledge of President Jefferson; how two years slipped by before Napoleon received the order on the Spanish officials for the delivery of Louisiana; how his plans for sending over an armed force to occupy the province were delayed by the destruction of his army in San Domin-

go and the lack of transports at home; how during all this time not so much as a formal protest was entered by our Government, need not be related. It is enough to know that at this critical moment the Spanish Intendant at New Orleans came to our aid, and without authority and in flat violation of the treaty of 1795, took away the right of deposit at New Orleans and closed the Mississippi to our trade and commerce.

As news of this act spread northward during the late autumn of 1802, the people in Tennessee and Kentucky, and in Ohio (just about to enter the Union as a State) cried out for war. How during the next session of Congress the Federalists took up the cry and strove to force the war; how Jefferson asked for $2,000,000 with which to buy West Florida and New Orleans, and so acquire the entire east bank of the Mississippi river; how the money was appropriated; how Monroe was sent to aid Livingston in making the purchase; how Talleyrand strove to prevent the sale; how Livingston passed over him and applied to the First Cousul; how Napoleon met the offer to buy West Florida and New Orleans with a tender of all Louisiana; how the price was fixed and the treaty ratified by the Senate is a story too long to be retold.

Congress having appropriated the money ($15,000,000) with which to pay for Louisiana, nothing remained to be done save to prepare for the formal delivery of the province to the United States.

Laussat's Proclamation.

Quite early in the year, when Napoleon had as yet no thought of selling the province, a plan for its government had been drawn up, and Peter Clermont Laussat sent out as Colonial Prefect. He reached New Orleans late in March, and promptly issued a proclamation in the name of the French Republic. He began by denouncing the separation of Louisiana from France in 1763, as the most shameful act ever done by a weak and corrupt Government; praised the love and loyalty which, in spite of this deed, the French of Louisiana had ever shown toward the mother country; reminded them that one of the first acts of the "magnanimous, just and powerful Government of Bonaparte" was to secure a retrocession, and promised that all manner of happiness should follow the new union of the mother country and her colony. A few of the French were delighted, and gave vent to their pleasure in long addresses to the Prefect, full of ardent wishes for the arrival of the expected expedition and the beginning of French rule. By the mass of the people Laussat was received with coldness or alarm. "His proclamation," wrote an eye-witness of the events of the time: "has been heard by some with sadness, and by the greater part of the inhabitants with the same indifference as the beat of the drum is listened to when it announces the escape of a slave or a sale at auction."

An Era of Uncertainty.

Not a few, recalling Napoleon's declaration: "Inhabitants of St. Domingo, whatever may be your color or your origin, you are all free!" feared that a day might soon come when a like decree might be proclaimed in the streets of New Orleans.

The Spanish part of the population was far from pleased, and no pains were spared by their rulers to pursuade, and, if necessary, force them to quit Louisiana and take up their abode in Cuba. Scarcely had the Marquis of Casa Calvo, charged with the duty of delivering the Province of

France, set foot in New Orleans than officers of the militia, the clergy, the small planters, the people about the post, were required to say whether they would or would not remain subjects of the crown of Spain, and more than one who answered nay was made to suffer for his temerity. The Ursuline nuns, recalling the closing of the religious houses in France in the early days of the Revolution, petitioned the King for leave to depart and find a new home somewhere else in his dominion. Permission was given, and on Whitsunday, when the sunset gun boomed from Fort St. Charles, sixteen nuns, escorted by the Governor General, by the Marquis de Casa Calvo and a great crowd of citizens walked from their convent to a ship and sailed away.

The End of Laussat's Regime.

Napoleon's declaration of war with Great Britain having prevented the departure of the troops and General Victor, who was to have received Louisiana from Spain, Laussat found himself without office, authority or support, and filled his dispatches to Minister Decres with descriptions of the city and its government. The fortifications erected a few years before by Carondelet, he said, were falling into ruins. The palisade was gone, or where it still stood was rotten ; the towers were crumbling, the ditches filling up, the bridges in decay, and the gates off their hinges and lying on the ground. Justice, he declared, was bought and sold ; every official, Governor, Intendant, Judge, Collector—all, in fact, down to the Constable, were venal, and in these statements, broad as they are, he was borne out by the American Consul in his dispatches to Washington.

In July rumors were current that Louisiana had been sold to the United States. Laussat indignantly denied them as the work of Anglo-Americans, till one day a vessel from Bordeaux brought him a commission to receive the Province from France and turn it over to the United States.

The Transfer to France.

The day chosen for the first of these ceremonies, Wednesday, November 30, 1803, opened dark and lowering. Casa Calvo, Salcedo and Laussat, attended by the clergy, the military officers and the people, met in the Cabildo, where Laussat presented an order from the King of Spain for the delivery of Louisiana, and his authority from Napoleon to receive it in the name of France. The keys of New Orleans were then handed over. Salcedo and Casa Calvo declared Louisiana and its dependencies to be the property of France, and absolved from allegiance to Spain all subjects of his Christian Majesty who wished to live under the authority of France. This done, the Commissioners went out on the balcony and looked down upon a sea of upturned faces, and the Place d'Armēs—not the little fenced park of to-day, but a great parade ground that stretched away from the Cathedral to the levee that kept out the waters af the Mississippi. In the presence of these dignitaries the banner of Spain, which flew from the staff in the court of the Place, was lowered and saluted, and the tricolor raised instead. Spanish Municipal Government was immediately abolished, a French code of government substituted, and the sale of Louisiana to the United States formally announced by proclamation.

No French troops came with Laussat ; the Spanish militia showed no willingness to serve under France till the arrival of

the Americans; just when they would come was uncertain, and, during the interval, the city, it was feared, might become the scene of disorder and crime. Such of our countrymen, therefore, as business or curiosity had brought to New Orleans, formed a volunteer company, and, joined by many young Creoles, offered their services to Laussat, and thenceforth armed bands patrolled the streets by day and night.

But it was not in New Orleans alone that fears for the safety of the city and Province were entertained. At Washington the Spanish Minister had three times protested against the sale of Louisiana. Napoleon had not as yet made good the conditions of retrocession. Nay, he had flatly violated one of them, for he had pledged himself never to part with the Province, but keep it forever a dependency of France. That the protest at Washington might be followed by armed resistance to the transfer at New Orleans seemed so likely to Jefferson that he ordered part of the militia of Ohio, Kentucky and Tennessee to be ready to march at a moment's notice, sent troops to Natchez, gathered others at Fort Adams near the old boundary line, and bade Governor Claiborne bring some with him from Mississippi.

Flags Saluted by the Forts.

The two Commissioners on behalf the United States were W. C. C. Claiborne, Governor of the Mississippi Territory, and General James Wilkinson. They met at Fort Adams in December, and at once set out for New Orleans, and on the 17th of the month camped two miles from the city gate. Visits of ceremony delayed their entrance till the morning of December 20, when the Commissioners and the troops marched through the Tchoupitoulas gate and on to the Place d'Armes, where the ceremony of the transfer to France was repeated in the hall of the Cabildo, or Hotel de Ville, as it now began to be called. The credentials of Claiborne and Wilkinson, the treaty of purchase, the powers of Laussat and the proces-verbal were read aloud; the delivery of Louisiana to the United States was proclaimed, the keys of the city were handed to Claiborne, and all who chose to become citizens of the United States were formally absolved from allegiance to France.

A short speech by Claiborne followed before the Commissioners stepped out on the balcony to witness the transfer of flags. The tricolor at the top of the staff was now drawn down, and the Stars and Stripes at the foot of the pole raised until the two met in the middle, where both were saluted by the forts, the vessels at the levee and the battery on Place d'Armes. Our flag was then raised to the top of the staff, and that of France lowered and carried away with much ceremony and placed in the hands of Laussat.

Unbounded Resources.

At the time the purchase was concluded few people in our country understood its far-reaching effects. The region was wild and desolate. It gave no promise of one day astonishing the world by its immense resources. It had not been carefully explored, and had given no assurance of boundless wealth. At that time it was more the ground of the hunter, the trapper and tribes of Indians, than of agriculturists and builders of a nation. But the forces of civilization have made a miraculous transformation in what was then an unknown realm, and even the discovery made by Columbus was scarcely greater than the acquisition of Louisiana, the fer-

tile valley of the Mississippi and the regions beyond.

Purchasing territory belonging to a nation by another nation rarely happens in peace, and is never purely a simple commercial transaction. We of the United States have won in war, and paid specifically, large acquisitions of land for the people—bought Alaska outright—conquered and gave away Cuba—received Porto Rico ceded direct by Spain—made a cash offer for the Danish Islands—annexed Texas and the Hawaiian Islands, and, first of all, and a good example, plainly purchased Louisiana, a masterpiece of diplomacy.

A Masterful Diplomat.

Mr. Jefferson was much more than the commander-in-chief. As chief Magistrate, he was the diplomat who inspired, organized and commanded. There could not be a greater contrast, if a selection was made from all the heads of nations since there were attempts to ordain and construct governments, and in the eager strife to make their essential art a practical science, than that of the leaders.

President Jefferson was as masterful a personage in the purchase proceedings, from the first appearance of success in the action, so clear and yet so complex, as was the First Consul Bonaparte, and it would be hard to say whether the mind of our third President, or that of the First and last Consul in France, had the broader understanding of the magnitude of the sale of land, and the scope of its influences upon the destinies of mankind.

They were men on a equality as to the vision that gave them power to scan broad horizons. Bonaparte saying, when urging haste in formalizing the treaty of the cession of Louisiana, fearing he might have to fight for New Orleans with England, if the secret got out, hotly declared that he had not a day to lose, felicitated himself that he had given the British a maritime rival, that some day would humble the pride of Great Britain. It was this that tempted him to throw in the large territory of Louisiana, with the remark that France would have no use for the Mississippi Valley if the mouth of the river was not French. He also had secret news that increased his urgency.

A Sharp Crisis.

Jefferson, when a crisis came suddenly, and there was another and a sharper one close at hand, in all probability, wrote a personal letter for special publicity, stepping over his Secretary of State to do it, declaring in effect, no friend of the United States could be in possession of New Orleans—that was "the one spot on earth that must be ours." The diplomacy of the President of the United States was no less peremptory, and his personality as undisguised and individual as the First Consul of France.

The history of the negotiation plainly shows the motives by which Napoleon was actuated. He disliked and feared England. He was jealous of the rivalry of Great Britain, and was resolved to give a stunning blow to the Power whose boast was that she ruled the sea.

He believed her ambition was not merely to maintain her naval supremacy, but to crush his armies on land and check his brilliant military successes.

The very name of Napoleon meant armies and battles and victories. A graphic account of his action in the Louisiana cession is furnished by reliable history:

"From one of the debates in the

English House of Commons he read a passage with which he appeared very much irritated.

"'France,' said the speech referred to, 'obliges us to recollect the injury which she did us twenty-five years since, by forming an alliance with our revolted colonies. Jealous of our commerce, navigation and riches, she wishes to annihilate them. The proceedings at the end of a peace made with too much facility compel us to appeal anew to arms. The enemy, by a dash of the pen, appropriates to himself territories more extensive than all the conquests of France for many centuries. He hastens his preparations; let us not wait till he attacks us. Let us attack first.'

Methods of Napoleon.

"'Now,' continued the First Consul, 'propose your theories and your abstract propositions, and see if they can resist the efforts of these usurpers of the sovereignty of the sea. Leave commerce and navigation in the exclusive possession of a single people, and the globe will be subjected by their arms, and by the gold which occupies the place of armies.' He then added these words, in which are found the first indication of his policy respecting the United States: 'To emancipate nations from the commercial tyranny of England, it is necessary to balance her influence by a maritime power that may one day become her rival; that power is the United States. The English aspire to dispose of all the riches of the world. I shall be useful to the whole universe, if I can prevent their ruling America as they rule Asia.'

"These discussions were to be terminated by war, and Bonaparte, who relied on himself alone to carry it on with success on the Continent, well knew that colonies could not be defended without naval forces; but so great a revolution in the plan of his foreign policy was not suddenly made. It may even be perceived, from the correspondence of the minister of foreign affairs at this period, how gradually and in what manner the change was effected. M. Talleyrand renewed, after a long silence, his communications with Mr. Livingston, the American minister. Bonaparte had only a very reduced navy to oppose to the most formidable power that has ever had the dominion of the ocean.

"Louisiana was at the mercy of the English, who had a naval armament in the neighboring seas, and good garrisons in Jamaica and the Windward Islands. It might be supposed that they would open the campaign by this easy conquest, which would have silenced these voices in Parliament that were favorable to the continuance of peace. He concluded from this state of things that it was requisite to change without delay his policy in relation to St. Domingo, Louisiana and the United States. He could not tolerate indecision; and before the rupture was decided on, he adopted the same course of measures as if it had been certain.

Flings Louisiana at Us.

"He had no other plan to pursue when he abandoned his views respecting Louisiana than to prevent the loss, which France was about sustaining, being turned to the advantage of England. He, however, conceived that he ought, before parting with it, to inform himself respecting the value of an acquisition which was the fruit of his own negotiations, and the only one that had not been obtained by the sword.

"Though full of confidence in himself, and in his method of forming a prompt and bold decision on state affairs, he willingly consulted those who possessed prac-

tical experience, and he had too much reliance in his own powers to fear engaging in a discussion. He sometimes allowed it to be perceived to which side he inclined, and he was not above that paltry artifice, so common with many persons, who, though they seek advice, form beforehand an opinion which they desire to see triumph.

"He wished to have the opinion of two ministers who had been acquainted with those countries, and to one of whom the administration of those colonies was familiar. He was in the habit of explaining himself, without preparation or reserve, to those in whom he had confidence.

Not a Day to Lose.

"On Easter Sunday, the 10th of April, 1803, after having attended to the solemnities and ceremonies of the day, he called these two counsellors to him, and addressing them with that vehemence and passion which he particularly manifested in political affairs, said: 'I know the full value of Louisiana, and I have been desirous of repairing the fault of the French negotiator who abandoned it in 1763. A few lines of a treaty have restored it to me, and I have scarcely recovered it when I must expect to lose it. But if it escapes from me, it shall one day cost dearer to those who oblige me to strip myself of it than to those to whom I wish to deliver it.

"'The English have successfully taken from France, Canada, Cape Breton, Newfoundland, Nova Scotia, and the richest portion of Asia. They are engaged in exciting troubles in St. Domingo. They shall not have the Mississippi, which they covet. Louisiana is nothing in comparison with their conquests in all parts of the globe, and yet the jealousy they feel at the restoration of this colony to the sovereignty of France, acquaints me with their wish to take possession of it, and it is thus that they will begin the war.

"'They have twenty ships of war in the Gulf of Mexico, they sail over those seas as sovereigns, whilst our affairs in St. Domingo have been growing worse every day since the death of Leclerc. The conquest of Louisiana would be easy, if they only took the trouble to make a descent there. I have not a moment to lose in putting it out of their reach. I know not whether they are not already there. It is their usual course, and if I had been in their place, I would not have waited. I wish if there is still time, to take from them any idea that they have of ever possessing that colony. I think of ceding it to the United States.

"'I can scarcely say that I cede it to them, for it is not yet in our possession. If, however, I leave the least time to our enemies, I shall only transmit an empty title to those republicans whose friendship I seek. They only ask of me one town in Louisiana, but I already consider the colony as entirely lost, and it appears to me that in the hands of this growing power, it will be more useful to the policy and even to the commerce of France, than if I should attempt to keep it.

"I Renounce Louisiana," Said Napoleon.

"'Irresolution and deliberation are no longer in season. I renounce Louisiana. It is not only New Orleans that I will cede, it is the whole colony without any reservation.'"

As soon as the negotiation was entered on, the American Minister declared that they were ready to treat on a footing of the cession of Louisiana, as already stated. The purchase was accordingly made and the momentous affair was closed.

QUESTIONS

ON THE

CONTENTS OF THIS VOLUME.

A KEY TO INFORMATION ON ANY GIVEN SUBJECT.

THIS masterly work is a Choice Library of Information. Its treatment of all subjects of special interest, is concise, accurate, and fully up to date.

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QUESTIONS AND ANSWERS.

QUESTIONS.	ANSWERS. PAGE.	QUESTIONS.	ANSWERS. PAGE.
What is the latest and most wonderful discovery in Telegraphy?	17	Describe the Telephone under the sea.	27
Describe the apparatus for Wireless Telegraphy.	17	How far can the sound be heard?	28
Name the chief discoverer in Wirelass Telegraphy.	18	Name one of the principal inventors of the Air Ship.	29
To what distance have Electric Signals been transmitted?	19	What service did the French Government render?	29
Describe the process of Wireless Telegraphy at sea.	21	Describe the personal appearance of Santos-Dumont.	31
What are Electric Waves?	25	How does Dumont guide his Air Ship?	32
		What are Dumont's opinions concerning flying in the air?	33

QUESTIONS.	ANSWERS. PAGE.
What speed is predicted for the Air Ship?	35
Give some account of other Inventors.	37
Describe the French Navy's Balloon.	38
When was the Fire Balloon invented?	40
Describe the collapse of Dumont's machine.	41
Describe the Floating Stable of Zeppelin's machine.	42
How are Telephone Connections made?	44
Describe the Multiple Switchboard.	44
What are the Striking Features of the new Telephone System?	44
What is the construction of Submarine Boats?	46
How long have they staid under water?	46
Describe the sinking and rising of Submarine Boats.	49
What was the Vital Test of the "Fulton?"	52
Of what use is the Submarine Boat in Naval Warfare?	53
What is the maximum speed on the surface?	54
How is the Boat driven?	54
What have Foreign Powers done to obtain Submarine Boats?	56
Describe the Goubert Boat.	57
What is the shape of the Holland Boat?	58
How many vessels did the French Government decide to build?	58
Who must be reckoned as among the Bravest Men?	59
What are the achievements of Life-saving Crews?	59
With what are Life-saving Stations furnished?	59
Describe some famous rescues.	60
Relate the account of seven heroes.	62
What is the story of a Brave Captain?	62
Give an account of the three-masted schooner Ulrica.	63
What became of Captain Jones?	64
What is the method of getting a Life-line to the wreck?	64
How were the men on the Ulrica saved?	65
How do Lumbermen generally get their logs to the Saw-mills?	65
How do Lumbermen sometimes get out of the forest?	65
What are the uses of the Gaff?	65
What is one of Canada's important sources of wealth?	66
What Kinds of Wood are found in different localities?	66
How old is the idea of the Automobile?	67
Describe Hancock's experiments.	67
For what purpose were the first Carriages built?	68
Who constructed the first Steam Carriages in America?	68
Describe the race in November, 1895.	68
Describe the Cosmopolitan race.	69
Describe the Columbia Electric Omnibus.	70
Give an account of New York's Fire-Automobile.	70
How does the Automobile affect the cost of transportation of the mail?	71
What use is made of the Gas Engine and Dynamo?	72
What are the advantages of the Dynamo?	72
Describe the Tonneau style of Touring Car.	72
What can you say of American Motor construction?	72
What is said of Steam Pleasure Vehicles?	73
Describe the various parts of the machinery.	73
What are the Rules for Driving?	75
How many revolutions can be made in a minute?	75
Describe the exhilaration of riding in a Horseless Carriage.	75
What New York woman is prominent in Politics and Charity?	76
What is the object of the Woman's Municipal League?	76
Give an account of Miss Chanler and her work.	77
Name the Distinguished Families connected with the League.	78
What have the Women's Patriotic Societies accomplished?	78
Describe the Junior Republic.	79
How do they encourage Patriotism?	79
Give an account of the work of the Daughters of the American Revolution.	79
What are the members taught?	78
What structures are erected for the transshipment of Grain?	80
Where are the largest built?	80
What kind of Elevators are sometimes used in New York?	80
How are cargoes of Grain unloaded in London?	80
Describe the Pneumatic Elevator.	81
What is the discharging capacity of this Elevator?	82
Where are the localities of the great Grain Traffic?	82
What is the effect of Good Crops on general business?	82

QUESTIONS.	ANSWERS. PAGE.
What is one of the chief features of Modern Commerce?	82
Name a woman Professor of Parliamentary Law.	83
With what Institution is she connected?	83
Who recommended her?	83
What qualities are required for such a position?	83
When was the old Brooklyn Suspension Bridge finished?	84
Why was a new Bridge decided upon?	84
Describe the new Brooklyn Suspension Bridge.	84
What are its dimensions and of what is it made?	84
What provision is made for Bicycles?	85
Where is the Footway located?	86
What provision is made to prevent crowding?	86
What are the dimensions of the Old Bridge?	87
What is the new plan for connecting New York with the Long Island Railroads?	87
What is the most serious difficulty in the way of constructing a Tunnel?	87
How will the Tunnel affect travel to Europe?	87
Describe the Roller Steamship	88
Who is the Inventor?	88
What is the main idea in the construction of this ship?	88
What advantages are claimed for this Vessel?	88
What are the disadvantages?	89
Of what speed is the vessel capable?	90
Describe the Screw Power.	90
How does the Vessel behave in a Rough Sea?	90
Where is the Beachy Head Lighthouse?	91
When was the construction of the Lighthouse begun?	91
Describe the difficulties of erecting the Tower.	91
What quantity of Granite and Concrete was used?	92
Describe the Lighting Apparatus.	92
Why is a Lighthouse especially needed at this point?	92
Describe the Glass Blowing Plant at Glenolden, Pa.	93
Why are Women employed?	93
How were the Girls taught to blow glass?	93
What gives the Women preference over the Men?	94
Give an account of the Champion Glass Blower.	94
How do the Girls do their work?	94
What kinds of Glass Ware are made?	94
Describe the manufacture of Capillary Tubing.	94
In what part of Paris is the Bank of France situated?	95
When was the Bank built?	95
When was it restored?	95
What exclusive right does the Bank hold?	95
What most impresses the visitor?	95
What is the duty of the Women who are employed?	96
How is the Specie handled?	97
In what manner is the business transacted?	98
What is the destination of the Notes?	98
How is money manufactured in the United States?	98
What invention revolutionized a Great Industry?	99
How did it affect the industrial development of the United States?	99
Give a sketch of the brief career of Eli Whitney.	99
How did Whitney obtain his first idea?	100
By whom was he befriended in his first efforts?	100
How was the invention received by planters?	100
What effect did the invention have on the whole Country?	100
What was the former process of separating the seeds from the Cotton?	101
Describe the workings of the Cotton Gin.	102
Describe Whitney's Struggles for his Rights.	103
What was Judge Johnson's opinion of Whitney's Question?	103
What did Whitney say in a letter to Robert Fulton?	103
To what did Whitney apply his Inventive Genius after Constructing the Cotton Gin?	105
What is considered the Queen of the Water Lilies?	105
Where is it found?	105
What is the average Diameter of its Leaves?	105
What other name is given to the Plant in some parts of South America?	105
What provision in England is made for the Cultivation of the Plant?	105
What weight is the Blossom Capable of Sustaining?	106
What gives a Vegetable Product its Value?	106
Describe Parhelia, or Mock Suns	107
Describe Arctic Mirage.	107
Describe the Aurora Borealis.	107
Describe the Spectre of the Brocken.	109
Describe the Fata Morgana	109
Describe Mirage.	109

QUESTIONS.	ANSWERS. PAGE.
Describe St. Elmo's Fire.	109
Describe The Will o' the Wisp.	109
Describe Aerolites or Shooting Stars.	109
Describe Comets.	109
Describe Waterspouts.	110
Describe Avalanches.	110
Describe Geysers.	110
Who wrote an address to the Rainbow?	110
When was Gold in paying quantities discovered in the Yukon Basin?	111
Who was the first White Man to cross the Coast Range?	111
What route did Holt take?	111
Into how many Divisions may the Yukon Section be Divided.	111
What annual amount of Gold has been realized from the Middle Division?	112
What is Miners' rate of wages?	112
Describe Glacier, Miller, Indian and Forty Mile Creeks.	112
Where was the scene of the first excitement about Gold?	113
Describe Williams' journey with Dog Team and Sled.	113
Give an account of Williams' Death.	114
Where is the scene of the latest excitement?	114
What statement did a Birch Creek Miner make?	114
Name one of the Principal Tributaries to Birch Creek.	114
How far has Birch Creek been Explored?	114
Where were Claims staked out?	114
Describe Preacher Creek.	115
Where were other Gold Discoveries made?	115
Where is the largest Placer Mining District on this Continent?	115
How does the Climate of the Coast Country compare with that of the Interior?	115
Describe the Surface of the Ground.	115
What is the object of Working the Sluices?	115
At what time of the year does cold prevent Further Mining?	115
What can you say of the length of the Day in this Region?	116
What is the chief Complaint of the Miners?	116
What was the weight of the Largest nugget and when was it found?	116
What prevents the search for Gold Quartz?	117
What are the prospects for obtaining Gold Quartz?	117
What are the Indications for Placer Mining in Alaska?	117
Describe the fascination of Placer Mining.	117
What is the conduct of Miners toward one another?	118
Give an account of the experiences of a Gold Seeker.	118
Describe the Dangers of the Journey.	120
Describe the trip up the Dyea.	121
Describe the process of Building a Raft.	122
What Game is to be obtained in these Regions?	123
What underlies the City of Dawson?	124
Describe the Screw Steamer Devonian.	125
How many persons will the Saloon Accommodate?	125
Describe the Machinery, including the Engines and Propellers.	125
How many Tons of Coal do the Bunkers hold?	126
What is the weight of her Full Cargo.	126
What is her rate of speed?	126
What is the largest Dinner of which we have any account?	126
What proportion of the population of London enjoyed King Edward's hospitality?	126
How many persons were required to wait on those who Dined?	126
Describe the courses at the Dinner.	126
Describe the Entertainments following the Dinner.	127
Describe the Dinner given to the Blind.	127
What was the effect on the populace of King Edward's Dinner?	127
Describe the Game of Polo.	128
In what countries is the Game of Polo played?	128
What is required to make a good Polo Player?	129
What prizes are generally offered for Polo Playing?	129
How is Silk produced?	129
Where, in this country, are climatic conditions favorable to Silk Culture?	129
When was interest aroused in Silk Culture?	129
What are the advantages of engaging in the Silk Industry?	130
What class of persons derive the greatest Benefit?	130
How many families in France raise Cocoons?	130
What State is foremost in Silk Manufacture?	130
Describe the Worm that spins silk.	130
What are the Shape and Size of Silk Worm Eggs?	131
How are the Insects killed?	131
What use is made of "floss?"	131

QUESTIONS.	ANSWERS. PAGE.
What kind of home does the Silkworm require?	132
Who introduced Silkworms into this country?	132
What injured the Silkworm in Connecticut?	132
How is Silk treated in China and Japan?	132
What use is made of "raw" Silk in Japan and Europe?	133
Describe the process of Reeling.	133
Describe the Dyeing and Printing of Silks.	133
State the Heads under which Trusts are described.	134
What is their Nature and how are they Formed?	134
What opinions of Trusts are put forward?	134
What are the arguments of the Opponents of Trusts?	134
What plan is proposed to obviate the Evil Effects of Trusts?	134
What are the Economic Effects of Trusts?	135
Give Statistics concerning the Standard Oil Trust.	135
How is Legislation affected by Trusts?	135
How is Competition affected by Trusts?	135
How are small Concerns affected?	136
What can you say of the Legality of Trusts?	136
How does one writer define a Trust?	136
What three results of Monopoly does Lord Coke mention?	137
What is the probable future of Trusts?	137
What are President Roosevelt's Views?	138
What does Roosevelt say of Special Legistion?	138
What is the Color of Slate?	139
Whence is Slate obtained?	139
What uses are made of Slate?	140
Why are Slate Roofs hot?	140
How are Quarries of Slate reached?	140
When was the Canadian Pacific Railway finished?	140
How long before the stipulated time?	140
What Subsidy is granted by the Canadian Government?	140
Describe the Scenery along this Railroad.	141
What is said of the Granby Mining and Smelting Company?	141
Relate the experience of the Royal Party in Canada.	141
Where are the greatest Gold producing Mines of the world located?	142
What is the value of the Commerce of Africa?	142
What Countries have the largest trade with Africa?	142
What can you say of Railroad development in Africa?	142
What is the number of miles of Railroad?	143
Describe the Diamond Mines of South Africa.	143
When was Gold discovered?	143
What is the Gold production of the "Rand?"	143
Where can Gold be found?	143
Where is the fastest Printing Press located?	144
How many eight-page Papers can be printed in an Hour?	144
How much paper is used on one of the Presses in ten Hours?	144
How far would the Paper reach in a straight line?	144
How long did it take to develop this Press?	145
Describe the Revolution in Newspaper Presses.	145
What Improvements have been made to the old style of Press?	145
Describe the Goss Press.	146
What material is used for making Paper?	147
What is the value of the Printing Press?	147
How is time saved by Wood's Invention?	147
What are the wonderful achievements of Newspaper Publishing?	148
What did Senator Depew call newspapers?	148
Describe the Rivers of Africa.	149
Describe Old Mosque near Timbuctoo.	151
Describe the River Niger.	149
Describe Mungo Park's Explorations.	149
Describe the Gulf of Guinea.	150
Describe the Wild Animals and Birds.	151
How are great Discoveries often made?	152
Relate Important Discoveries that have been made by Accident.	152
How was "Saccharine" Discovered?	153
How did Edison Discover the process of Metal Extraction from Ores?	153
What makes some Men greater than others?	153
Where are large quantities of Rubber obtained?	154
To what height does the Rubber Tree grow in the valley of the Amazon?	154
How does the India Rubber Collector do his Work?	154
Describe the localities in Brazil where the Rubber Tree grows.	154
When was India Rubber first brought to England?	155
What does Dr. Priestly say of it?	155
What articles are made of India Rubber?	156
Describe Waterproof Cloaks.	156
Describe a valuable tree that grows in Spain	156

QUESTIONS.	ANSWERS. PAGE.
Describe the process of Making Shoes in South America.	157
Describe the fruit-bearing trees of South America.	157
What difficulties had to be overcome in building the Dortmund Ems Canal?	157
How is this Canal regarded in Northern Germany?	157
What becomes of the old-fashioned Canal Lock?	158
What are the means of Transportation?	158
Describe the Shoe made for Walking on the Water.	159
By whom was it Invented?	159
How does walking affect the Muscles of the Lower Limbs?	159
Name the most characteristic of the Slave Holding Ants.	160
Describe their Mandibles or Jaws.	160
How do they treat their Slaves?	160
At what rate do the Amazon Ants move?	160
Describe the line of March and the Halts.	160
How does the Amazon Ant secure its Booty?	160
What does the Amazon Ant do with the Captured Nymphae?	161
For what are these Ants remarkable?	161
Describe the combats of two Armies of Ants.	161
Have Ants any Reasoning Capacity?	161
What story of Patriotism is related by a Student of Ants?	161
Narrate the story of Livingstone's experience in Africa.	161
Describe the Building constructed by Ants.	161
What can you say of the Ravages of White Ants?	163
How did the Ants encountered by Livingstone gain an entrance to Tin Cans?	164
What is the Largest Animal in the world?	164
Mention the Characteristics of the Elephant.	164
What use is made of Elephants in India?	164
Mention an Interesting Case of the Sagacity of an Elephant.	165
What did an Elephant do to cure its own Leg?	165
Describe the work done by Elephants in the Teak Yards of Burmah.	166
How old are the Elephants when they begin to work?	166
How long does their work continue?	166
Describe the Elephant's memory of Injuries.	167
How did an Elephant in India lose its Life?	167
Narrate the story of an Elephant and a Young Child.	167
Describe the antics of an Elephant in Paris	167
Describe the dexterity with which an Elephant handles his Trunk.	167
Describe the sagacity of a Wounded Elephant.	169
For what was Egypt formerly noted?	169
What could Engineers do in the early days?	169
Who originated the Nile Dams?	169
Describe the construction of these Dams.	171
When and where was Miss Ellen Stone, the Lady Missionary, captured?	171
Who was captured with her?	171
What sum of money did the Brigands demand for Miss Stone's release?	171
Narrate the experiences of the Captured Missionaries.	172
Relate the history of Miss Stone.	173
Describe the ransom and return of the Missionaries.	174
How was Miss Stone received on her return to the United States?	175
What now is the form of Government in Cuba?	175
What has our Government done to aid Cuba?	175
What are the Results of our Action in Cuba?	176
What is the effect on Public Schools and Prisons?	176
When was Cuba formally transferred to the Cuban Government?	176
When was Hawaii annexed to the United States?	177
What is the Population of the Hawaiian Islands?	177
What are their Products and Industries?	177
What is the Character of their Inhabitants?	177
When did the United States take possession of Porto Rico?	178
What is the number of the Population?	178
What are the Mineral and Vegetable Products?	178
Describe the Island of Guam.	179
" " " " Tutuila.	179
" " Samoan Islands.	179
" Wake Island.	179
How many islands are there in the Philippine group?	180
What is the Climate?	180
What is the Mineral Wealth?	181
What are the Agricultural Products?	181

QUESTIONS.	ANSWERS. PAGE.
Name the Acquisitions of Territory by the United States.	181
Describe the influence of Light in the cure of Diseases.	182
What cure was performed on a Prince of Wales?	182
Who introduced the Light treatment to the London Hospitals?	182
On what principles is the Light Treatment based?	182
What is the Finsen Discovery?	183
Who proved that Sunlight can kill Microbes?	183
Describe the Apparatus used in Light Treatment.	184
What value does Denmark place on Light Treatment?	184
What has been accomplished in the Training of Animals?	184
How is a young Stag taught to Leap into the Water?	185
What do Hunters say concerning the Leaping of Deer?	185
Describe the Diving Horses at the Crystal Palace.	185
Describe the Headlong Plunge of the Horses.	186
What can you say of the Sagacity of Horses?	186
In what places in America have Diving Horses been Exhibited?	186
What is the longest Railroad in the World?	187
When was it commenced?	187
How long did it take to construct it?	187
What was the total cost of theRailroad?	187
How many miles in length?	187
Describe some of the Bridges.	188
What were the Objects in building the Siberian Railway?	188
Describe the emigration since the railway was finished.	188
What new Commercial Port was Established?	188
What is the effect on the Vast Country of Siberia?	189
How long did it formerly take to go from London to Hong Kong?	189
How long does it take now?	189
Describe the ride over this Railway.	189
How does it rank among the Wonders of the World?	190
Where were the Engines built?	190
Describe the Construction of the Cars.	190
Describe the Stations along the Route.	191
How is the price of Eatables fixed?	191
What is the aspect of the Country along the Siberian Railway?	191
Who was Count Rochambeau?	192
When was he born?	192
What changed his Vocation?	192
On whose staff did he obtain a Position?	192
What was his Conduct at the Siege of Namur?	192
Whom did he Marry?	193
How did he win the Cross of St. Louis?	193
Describe his Exploits in 1757.	194
What were his personal Characteristics?	194
What part did he take in the American Revolution?	194
Describe the action of the French Troops at Newport.	195
When and where did he meet Washington?	195
What Decision did they make at that time?	195
Describe Rochambeau's movements into New Jersey and Pennsylvania.	196
Describe the plans for the Capture of Cornwallis.	196
What was the behavior of the French troops at Yorktown?	196
How was Rochambeau received on his return to France?	196
Give Rochambeau's history after his Exploits in America.	197
How was he honored by Bonaparte?	197
What were the conditions of France's Alliance with our Country?	187
What service did French Heroes render to our Cause in the Revolution?	187
What is considered the World's greatest Natural Wonder?	198
When and by whom was it Discovered?	198
Describe the Niagara River.	198
What are the best points for obtaining a View of the Falls?	199
What Geographical changes are going on?	200
How is the power of Niagara utilized?	200
Give an account of a Woman's Plunge over Niagara Falls.	201
Describe the Construction of the Barrel.	201
What were her sensations while going over the Cataract.	202
At what point did the Barrel land?	203
Where is the largest School in the world located?	203
How many pupils has it?	203
How is the Educational Work carried on?	204
What is the design of the School?	204
What is the largest class of Pupils?	205
What are the advantages of this School?	206

QUESTIONS.	ANSWERS. PAGE.
Describe a famous Painter who has no Arms.	206
What is his History?	206
What kind of Work does he prefer?	207
Mention one of the famous dishes for Epicures.	208
Describe the Land Turtles.	208
What is the process of preparing them for Market?	209
What does Audubon say of the life of the Turtle?	210
How are Turtles caught on shore?	210
What is Japan's position among the Nations of the East?	211
What is the history of the Mikado?	211
What Five Laws form Japan's New System of Government?	211
What great step did the Empire take in 1899?	212
What was the effect of the War with China?	212
What is the Coinage System of Japan?	213
What are the Relations between Japan and the United States?	213
Describe Japan's Navy.	213
What is the extent of Japan's Commerce?	214
Give an account of the Emperor's Family.	214
What is the difference between the Inventor and the Discoverer?	215
What can you say of Skeptics and Scoffers?	215
Describe Liquid Air?	216
Name the Discoverers of Liquid Air.	216
What is the process of Manufacturing Liquid Air?	217
To what use can this Discovery be applied?	219
How are the greatest Explosives manufactured?	220
Describe the application of Liquid Air to Machinery.	220
Describe the Dry-dock at Kiel, Germany.	221
What are the Dimensions of the Dry-dock.	221
Describe the underground Shop.	222
Whence is the Power obtained?	222
How much money did Mr. Carnegie subscribe at one time for Higher Education?	222
Where is the Institution located?	222
What is the Object of the Institution?	223
Mention the Aims of the Higher Education.	224
In what part of California are the Giant Trees located?	225
Describe the surrounding Scenery	225
Describe Big Tree Cottage.	227
What technical names have been given to the Trees?	227
How many persons danced on the Stump of one Tree?	228
Describe the "Mother of the Forest."	228
Describe the "Father of the Forest."	229
Describe other famous Trees.	229
What are the "Three Graces?"	230
What is supposed to be the Age of the Grove?	231
How do Breakwaters differ from Piers?	232
Into how many Classes may they be divided?	232
Describe Artificial Harbors.	233
What use is made of Concrete?	233
What is named the "Harvest of the Sea."	234
How is the supply of Fish increased?	234
What are the most valuable Marine Animals?	235
Describe the capture of the Tarpon.	236
Name the principal Yacht Clubs.	236
What is an Irish Tradition?	236
When was the America Cup won from England?	237
Describe the Yacht that first won the Cup.	237
How many other Racers were in this contest?	237
Describe the modern Yacht.	238
State the difference between "Columbia" and "Shamrock II."	238
Name the Owners of the contending Yachts.	230
Describe the Victorious Race of the Yacht "America" in the great International Regatta	239
How was the Victory received by the general Public	248
Where are Ostrich Farms located in this Country?	249
Describe a Pacing Ostrich.	249
How fast can an Ostrich travel?	249
Who was the first Female President of a Telephone Company?	250
Describe Mrs. Brett.	250
Relate her History.	251
What Obstacles did she overcome?	252
What part was acted by her little Boy?	252
Give an account of the Boy's Speech.	253
How did he obtain names to the Petition?	253
What other Skins are in demand besides Sealskins?	254
Describe the Ermine.	254
In What Countries is the Ermine found?	255
What Skins were wanted for King Edward's Coronation?	255
Where is procuring Furs a regular Trade?	256
Why is there a lack of traveling facilities in some parts of South America?	256

QUESTIONS.	ANSWERS. PAGE.
Describe Guatamala.	256
What are the Vegetable Products?	257
What are the Industries?	257
What are the Modes of Travel?	258
How do they differ from Traveling in Switzerland?	258
What effect is caused by the news of a Disastrous Shipwreck?	258
Describe some of the most famous Shipwrecks.	258
Describe the Burning of the steamship Austria.	259
Describe the loss of the steamship Atlantic.	259
Describe the loss of the Ville du Havre	261
How were some of the Passengers Saved?	261
How many lives were lost by the sinking of the steamer Utopia?	262
What was the loss of life in other shipwrecks?	263
Where was the Steamship Oceanic built and for what Company?	264
Of what material is she Constructed?	264
What was the cause of failure in the Steamship Great Eastern?	264
What is the mode of constructing a great Steamship?	265
Describe the Inventions for saving ships from sinking.	266
What are the dimensions of the Oceanic?	267
Describe the Swiss Valleys.	268
What animal is found in the mountains?	268
Describe Alpine Climbing	269
Describe Monte Rosa and surrounding Scenery.	270
What are the Perils of ascending the Matterhorn?	270
How high is the Matterhorn?	270
Who were the first to attempt to ascend it?	271
What accident occurred on the Matterhorn?	273
Describe the Matterhorn.	274
What is the most famous Mountain of Switzerland?	275
Narrate exciting Adventures in the Alps.	275
Describe the far-famed Rigi.	278
Describe the Railway up the Rigi.	279
Describe the Weather Observatory on an Alpine Peak.	280
What name is given to the Tusk of the Male Elephant?	281
What substances come under the name of Ivory?	281
Where is Ivory principally obtained?	281
How many Elephants are killed yearly for Ivory?	281
Describe the finest specimens of Ivory ever sent to Europe.	282
How can decayed Ivory be Restored?	282
How are Balls within Balls made?	283
Narrate an Incident concerning General Jackson?	283
Give an account of the Boy Soldier.	284
How did he regard his Mother?	284
Narrate the account of Jackson's Duel.	285
What was the Result of the Duel?	286
What are the most famous Cannons in the World?	287
Describe the largest Cannon.	287
Describe eccentric War-ships.	288
What Designs did Fulton make?	288
Describe his Magnum Opus.	288
Describe the Fulton.	289
Mention Fulton's imitators.	290
Give an account of Jules Verne's romantic description.	290
Name some of the Old Relics.	291
Describe the original Cigar Ship.	292
Describe the Kaiser Frederick III.	293
What is the most common Chinese mode of Transportation?	293
What are China's greatest Rivers.?	293
Describe the Grand Canal.	294
What are the advantages of the Canal?	295
Describe some curious Chinese Amusements.	298
Describe the Mississippi River.	299
" " Missouri "	299
" " Columbia "	300
Describe the other famous Rivers of the World.	301
What uses are made of the Motor War Car?	305
What are the facts concerning the Car?	306
Who or what is Lloyds?"	307
What is their system of Insurance?	307
What was the Origin of the Concern?	307
What does the World pay for its Rulers?	308
What does every English subject pay for the maintenance of the King?	309
What was the offer of Victor Emanuel?	310
What can you say about Royal Poverty?	310
Who made the present American Flag?	311
Where was it made?	311
Describe some Historic Flags.	312
" the Rattlesnake Flag.	313
Where was the first use made of the Stars and Stripes?	313
Where was it next Used?	311
Describe the Confederate Flag.	314
Describe the ' Unite or Die " Flag.	315

QUESTIONS.	ANSWERS. PAGE.
What are the profits of the Beet Sugar Industry?	316
What was the early cost of Sugar in Europe?	317
What is the amount of Sugar used annually by this Country?	317
Where and when was the first effort made to manufacture Beet Sugar?	317
Describe the Process of Making.	318
Describe the new "Maine" Battleship.	319
What is its highest Speed?	319
Relate the story of the old "Maine."	320
Describe the Armor Belts.	320
Name Five great Inventors	321
Give the history of Edison.	321
Give the history of Morse.	323
Give the history of Robert Fulton and his Steamboat.	324
What traits of Fulton made him Successful?	326
When did James Watt begin his Experiments?	328
What was his famous Discovery?	328
Describe the "Old Bess Engine."	329
Give the story of Matthew Bolton.	329
What improvements did George Stephenson make in the Steam Engine?	330
Describe one of Stephenson's masterly Inventions.	331
What was the speed of the first Locomotive?	332
Where were Iron Roads laid in England?	332
What is the most useful Metal?	333
What uses are made of Iron?	333
Describe the Pig Iron Industry?	334
How are our desert lands Reclaimed?	335
Describe the work of Irrigation.	335
How are deep Wells Drilled?	336
When was the Irrigation Act approved?	337
Where is Irrigation successfully carried on?	337
Describe the Pennsylvania Railroad Tunnels.	338
What of the Thames Tunnel, London?	339
What are the advantages of the New York Tunnels?	340
What is their Depth?	340
Describe the Rotary Snow Plow.	341
Whence does the Plow get its Power?	341
Who is described as a Millionaire Patriot?	342
What is the estimate of his Wealth?	343
What can you say of his Inventive Skill?	343
What are his Hobbies?	343
For what is the Irish coast noted?	344
Describe the Causeway	344
Describe the surrounding Scenery,	345
Name one group of far-famed Lakes.	345
What was the old-fashioned way of making Bread?	346
What is the modern way?	346
Describe Gluten Bread.	347
What is the effect of Machinery in Bakeries?	347
Where is Fingal's Cave	348
Describe its Dimensions.	348
Describe the Scottish Islands and Rivers.	348
Describe the Great Southern Ocean.	349
What is its depth?	349
Describe Victoria Land.	349
Describe Ross' Voyages.	350
Describe the Expedition of 1898.	350
What present was made by the Prince of Wales?	351
Describe Mount Erebus.	352
How to maintain the Health of the Body?	352
Give some Rules for Home Training.	352
Describe Tumbling Movements.	353
When is the Body in Health?	355
What use should be made of Drinking Water?	356
How is Force Generated?	357
What is the effect of Overeating?	357
How are the Cells and Tissues of the Body nourished?	358
Describe the Movable Walls of the Body.	358
How would you develop the Muscles?	359
What are the best Exercises for the Arms?	360
What are the best Movements for the Lower Limbs?	360
Describe the best modes of Breathing.	361
How to Inhale.	361
What about Fast Eating?	362
What is the best method of Preserving Health?	362
Mention some of the Cities that have Underground Transportation.	362
Describe the New York Subway.	364
What was its cost?	364
Describe the Boston Subway.	365
What can you say of its cost?	366
Describe London's Undergound Railway.	367
What cause necessitated Electric Railways?	367
What is their Carrying Capacity?	368
What Difficulties were overcome?	368
Name the solution of Transportation in crowded Cities.	369
How was the problem solved in London?	369
How in American Cities?	370
What is the general character of all these Railways?	371

QUESTIONS.	ANSWERS. PAGE.
Describe the rush of a Fire Engine in the City.	371
Describe the "Platform" of the Fire Department.	373
Describe the Pneumatic Fire Ladder.	373
How is the Ladder raised?	373
To what height can the Ladder be raised?	374
Describe the new Fireman's Dress.	375
How is air conveyed to the Smoke Cap?	375
What is essential to Life?	375
Describe the Blind Creatures of caves and streams.	375
Describe the burrowing Sightless Fish.	375
What Insects are found without Eyes?	376
What is the effect of disuse on the Eyes?	377
What compensation is there for the loss of Eyesight?	378
Describe the Croton Aqueduct.	379
When was the Aqueduct constructed?	380
What is its length?	380
What is Thibet often called?	381
Describe the Country.	381
What is the common Food of the people?	381
What is their chief Wealth?	383
Describe the Prayer Wheels.	383
What have the Moravians done for Thibet?	384
Where is the only Buddha Temple in America?	384
What was its Cost?	385
How many years were required to Construct it?	385
Describe the Cleansing Ceremonies.	386
What use is made of the Lotus?	386
Describe the Artificial Blossoms.	387
Describe the Panels.	387
Name a famous family of Trick Bicyclists.	388
Describe their Feats.	388
Mention other skillful Riders.	390
Describe the old forms of Velocipedes.	391
How is riding the Bicyle learned?	392
Describe a Railway for Bicyclists.	393
Describe the Tricycle Boat.	393
What is the history of Cycling?	394
How does the new Bicycle differ from the old style?	395
Describe the X-Rays.	395
What use is made of them?	395
When and by whom Discovered?	396
Where were experiments carried on in this Country?	396
Describe experiments on Animals.	397
What of the location of Bullets in the Human Body?	397
Describe the Apparatus for applying the Rays.	398
Where is the "Switzerland of America?"	399
Describe the entrance to the Yosemite Valley.	399
What is the "South Dome?"	400
Describe the Gorgeous Spectacle.	401
Describe Glacial Point.	401
What Trees and Plants are found?	402
Mention some notable Mountains.	402
What can you say of the Atmosphere?	403
How does the Yosemite compare with Swiss Scenery?	404
What are the prominent features of the Alps?	405
What Waterfalls abound in the Yosemite?	405
What of the Dizzy Precipices?	407
What of the Snow capped Mountains?	407
How is our Country Governed?	408
Describe the Executive Department.	408
What are the Powers of the President?	408
Name the different Executive Departments.	409
What officials make up the Cabinet?	409
What is their Salary?	409
Describe the Judicial Department?	409
How many Judges has the Supreme Court?	409
What is their Salary?	409
What is their Jurisdiction?	410
Describe the Court of Appeals.	410
When was it Organized?	410
Describe the Legislative Department.	411
Who compose the Senate?	411
What is their Salary?	411
What are the Powers of the Senate?	411
Describe the House of Representatives	411
What are the Powers of the House?	411
Describe the Sessions of Congress.	411
What are the Powers of Congress?	411
When was the Weather Bureau established?	412
What other Countries have such Organizations?	412
How do animals and birds forecast weather?	412
What is said of Spiders as weather prophets?	413
Where do the heaviest Rains occur?	413
What attempts have been made to produce Rainfall?	413
What is said of heat in producing Rain?	414
What can you say of the growth of our Navy?	414
Describe the modern Battleship.	415
What changes have been made by the introduction of Steam?	415
What accomplishments are expected from a Naval Officer?	415

QUESTIONS.	ANSWERS. PAGE.
What is said of the Battleship Oregon?	416
Describe the Victories of the old Navy.	417
How does the Navy show the Character of our People?	418
Name the world's most noted Cathedral	418
What Coronations took place there?	418
By whom was Napoleon crowned?	419
Describe the Spectacle.	419
What was the Pope's Prayer?	420
When did the most wonderful Meteoric Shower occur?	420
What effect did it have on the Public?	421
What was the scene at the Falls of Niagara?	421
Describe the Phosphoric Lines.	422
Describe the Fireballs.	422
From what point in the heavens did they issue?	423
What remarkable change of Weather occurred?	424
What became of the Meteors?	423
What can you say of their Velocity?	424
What is said of Nebulous Matter?	425
What views are held as to the Origin of Meteors?	425
What Phenomenon attended the Shower?	426
Give a history of Meteoric displays.	426
Describe one Meteor of surpassing Beauty.	427
How does the speed of Meteors compare with that of a Cannon Ball?	428
Describe the greatest Meteorite on record.	428
By whom and where was it found?	428
Describe the search for it.	429
What is its size?	429
What would be the cost of removing it?	429
Describe the feats of the Kremo family of Athletes.	430
How were they trained?	430
Mention the principal Coal Fields of the United States.	431
Where are the Anthracite tracts?	431
What is the Coal area of the different Countries?	433
When was the first Earthquake noticed in this Country?	433
Describe Earthquakes.	434
Describe the Charleston Earthquake.	437
Describe the great Earthquake in the western part of the United States.	441
What Birds are employed by Falconers?	448
How are the Hawks trained?	449
Where is Falconry practiced?	450
What products can the Philippines export?	451
How do these compare with those of Cuba?	451
What is the Rice production?	452
What are the available Imports?	452
Describe the most wonderful Clock.	453
Describe the Seventeen-year Locusts.	454
What are the habits of this Insect?	456
Who were the first Inhabitants of the Western World?	457
Mention Dr. Uhle's Discoveries.	458
What is the proportion of the two Sexes?	459
What are the effect of Migration?	460
Where is the greatest excess of Men found?	461
Describe the Traction Engine.	461
What use was made of it in South Africa?	462
Describe the Bone-plated Armadillo.	463
Where is its Skeleton found?	463
Describe the Motive Power of Electricity.	464
Describe the Suspended Railway.	465
What can you say of Uncle Sam as a business man?	465
What is the cost of Courts?	467
What is the largest item in Federal expense?	467
How does the President receive his pay?	468
Describe the Amazons of Russia.	468
What is their form of Government?	469
Mention the most disastrous Conflagations known to history.	470
Describe Chicago's great fires.	471
Name the highest Mountains.	472
Describe the largest Park in the world.	473
Describe the Hot Springs.	473
Name the height of the principal Monuments and Buildings.	474
Describe the Washington Monument.	474
Mention the size of the Lakes, Seas and Oceans.	475
Where is the deepest Lake in the world?	475
Name the longest Tunnels in the world?	475
What is the capacity of the largest Churches and Halls?	476
What mysteries are connected with Electricity?	476
What are the various forms of Vibrations?	477
How is Electricity produced?	478
Describe the power of heat.	479
Describe the Electrical Current.	479
Mention one of Edison's great triumphs.	480
Describe the Phonograph.	480
How are Phonographic Records made?	481
What can you say of Electricity as a Motive Power?	483
Describe the Capital of Germany.	483
What of the Commerce and Manufactures?	484
Name the chief Industries.	484
What are the favorite Sports?	485

QUESTIONS.	ANSWERS. PAGE.
Describe a dangerous Circus Feat.	486
Name the greatest Music Composers.	487
Relate the history of Bach.	488
Relate the history of Haydn.	489
Relate the history of Mozart.	489
Relate the history of Beethoven.	489
Relate the history of Mendelssohn.	490
Relate the history of Meyerbeer.	490
Relate the history of Wagner.	490
Relate the history of Liszt.	490
Describe the new Niagara Bridge.	491
What is the largest Truss Iron Bridge in the world?	491
When was work on the Niagara Bridge commenced?	492
How high above the water is it?	492
Describe Nansen's Polar Expedition.	493
What were his plans for reaching the Pole?	493
In what respects was his Expedition a success?	495
Describe his Ship.	496
What was the object in its Construction?	496
Describe the rescue of Nansen.	497
What was gained by his Expedition?	498
Describe the Yacht built for the German Emperor	499
Name the various Apartments.	500
Describe a curious Bell Tower at Tacoma.	500
What are the Ornaments of the people of Paraguay?	501
Describe a new Food Plant.	501
Describe the Education of Chinese girls.	501
Mention some facts about Greenland.	502
Mention one source of Chewing Gum.	502
What is known of ancient Glass Painting?	502
Who narrated the story of Pompeii?	503
What was the form of the cloud resting on Vesuvius?	503
What became of the Cloud?	503
What was discharged from the Volcano?	504
Describe the flames of Vesuvius.	505
From what was the chief danger?	505
What was the state of the Sea?	505
What terrors were added to the Scene?	506
What was the effect upon the Sea?	506
Describe an escape from Danger.	507
How were the Inhabitants affected?	507
Describe the downfall of Ashes.	507
What was the appearance of the Morning?	508
What catastrophe befell Martinique and St. Vincent?	508
What town was destroyed?	508
How did the eruption begin?	509
Describe the efforts of the People to escape.	509
What was the effect of the eruption on Buildings?	509
Describe the scene in the Churches.	510
What became of the Woodwork?	511
How many seconds did it take to destroy the town?	511
Describe St. Pierre before the Eruption	511
What befell the Statue of Christ?	512
What feast was in progress at the time?	512
Describe the Birds along the Seashore	512
Describe the quakings of the Mountain.	514
Describe the scene on board the Ships.	514
How was the City constructed?	514
Describe other Volcanoes in the vicinity.	515
Describe the Disaster on St. Vincent.	515
How far did it spread?	515
What can you say of the Musical Skill of the People?	516
What of the Odors?	517
Describe the scene in the Cemetery.	517
What are the habits of the Negro workmen?	517
Where was one body found?	518
What was the estimate of the loss of Life?	518
What Volcano has the largest Crater?	519
Describe Kilauea.	519
What notable Eruptions of this Volcano have occurred?	519
Describe Mauna Loa.	519
What is the size of its Crater?	519
How do the Eruptions affect the area of Hawaii?	520
What can you say of New Zealand?	520
Mention the height of some of the loftiest Volcanoes	521
What is the greatest length of the Island of Jamaica?	521
What is its greatest Breadth?	521
What can you say of its Harbors?	521
What of its Vegetation?	522
What does the Island export?	523
When was Jamaica discovered?	523
What is its History?	523
How are Bananas prepared for market?	523
Mention the great Canals of the world.	524
Describe the Canals of Germany.	524
What use is made of Canals?	525
What was the cost of the Welland Canal?	526
What is the freight tonnage of the American and Canadian Canals?	526
Describe the journey of the Prince and Princess of Wales to the British Colonies.	526
What rights has the United States in the Panama Canal?	526

QUESTIONS.	ANSWERS. PAGE.
How were they obtained?	526
What is the cost of the Panama Canal?	527
What action did Congress take?	528
Describe the Expedition sent by the Smithsonian Institute to Cuba.	528
What animals were procured in the Island?	529
Describe the great Lizards.	529
Describe the Monstrous Rats.	529
Where were they obtained?	529
Describe the huge Rats.	530
What is their value for eating?	530
Describe the Tropical Birds.	530
Give some account of Minnesota.	531
What can you say of the Waterfalls?	531
Describe the Indian Massacre.	532
Describe the Falls of Minnehaha.	532
How is the costliest Furniture Carved?	533
What use is made of Clay?	533
How is the Plaster Model handled?	534
Describe Human Models.	534
Describe the Wood that is used.	535
How does modern Splendor compare with that of former times?	535
What was the saying of Robert Burns?	535
Narrate the story of a Fortune Teller.	536
What is her style of Dress?	536
What distinguished people were her Patrons?	537
What other means did she employ for Fortune Telling?	538
Name cases of great Longevity.	538
Relate the history of Robert Taylor.	539
What parts of New England favor Long Life?	539
How may great Age be attained?	539
How do the Married and Unmarried compare in age?	539
Where was the largest Schooner built?	540
What are its Dimensions?	540
What weight of Cargo can it carry?	541
What can you say in favor of the Schooner rig?	541
What use is commonly made of American Schooners?	541
Explain the "Devil's Corkscrew."	542
Where are columns of Quartz found?	542
Describe Prof. Barbour's Expedition.	542
What is the Origin of the Quartz Columns?	543
Describe the Inland Sea of ancient times.	543
Describe the ancient Ferns.	543
Where did modern Gymnastics originate?	544
Who was the father of them?	544
Describe the Turnfest.	545
Describe the Gymnastic exercises.	545
How many persons have been known to take part?	545
For what is the State of Colorado famous?	545
Describe its Canyons and Underground Rivers?	545
What is the make-up of the Population?	546
Describe the Rock formations.	546
Describe the "Old Man of the Mountain."	546
Describe the Electric Restaurant.	547
How is it operated?	547
What supplies the Motive Power?	547
How is the Cooking done?	548
Describe the Wheelpits.	548
When was Petroleum discovered in the United States?	549
When was it first known?	549
Where are the best Wells located?	549
What use did the Indians formerly make of Oil?	550
What is the value of the Oil for lighting?	550
Who first bored for Oil and when?	550
Describe the Seneca Oil Company.	551
Describe the effect of the Discovery.	551
Describe the operations on Oil Creek.	551
What new Discoveries were made?	552
What were the Profits to the Owner?	552
Describe the Rouse Well.	553
What accident occurred?	553
Describe an Oil Well on Fire.	553
How many barrels do some Wells produce daily?	554
When was the process of Refining Oil commenced?	554
What was the fate of the 'Oil Bubble?"	555
What is the export trade in Oil?	555
Describe the loss of great Fortunes.	555
Narrate the story of "Coal Oil Johnny."	556
What is known of the Origin of Oil?	556
What is Prof. Dana's opinion?	556
What chemical changes produce Oil?	557
Describe the discovery of Oil in Texas.	557
Describe the ancient modes of Travel.	558
What dangers attend the four horse coaches in the Far West?	558
Describe the evolution of Railways.	559
What rate of speed was first thought to be possible?	559
What Railway first used the Steam Locomotive?	559
Describe the old Colliery Railways.	559
Give an account of a remarkable Artist of Antwerp.	560
What does he substitute for arms?	560
Name some of his distinguished Patrons.	561

QUESTIONS.	ANSWERS. PAGE.
Who was the most notorious Pirate of the Nineteenth Century?	561
Narrate the story of the brig "Vineyard."	561
What became of the Master and Mate?	562
Where did the crew of Conspirators land?	562
Describe the arrest of the chief Pirates.	562
What Confession did they make?	562
What was the result of their Trial?	563
Relate the story of Gibbs' career.	563
How did he spend his money?	563
Where did he cruise for Prizes?	563
Where were the stolen goods landed?	564
How many years did he roam the Seas?	564
What vessels were captured?	564
Why did he repair to Havana?	564
Relate the story of a Dutch ship.	564
Relate the story of a beautiful young woman.	565
What other Ships were destroyed?	565
How was Gibbs deceived?	565
Describe his final capture.	566
What was his Demeanor?	566
What account did he give of himself?	566
What confession did he make on the scaffold?	566
Describe the Execution of Gibbs and Wansley.	566
What great Victory did the Indians of the Northwest gain in 1791?	567
What Victory was gained by General Wayne?	567
Describe other Conflicts with the Indians.	567
Describe the Expedition of General Harmer.	567
What was the effect of the Disasters?	567
What was the action of Congress in 1791?	567
What was Washington's advice?	568
Describe the defeat of St. Clair.	568
How did the defeat occur?	568
Describe the Indian attack on the Militia.	568
What was the Indians' manner of fighting?	569
What was the fate of General Butlers' command?	569
To what point did the shattered Army retreat?	569
Where was Fort Washington located?	569
How did the news of the defeat affect Washington?	569
Where was he when he received it?	570
Describe Washington's anguish.	570
What was his treatment of St. Clair?	570
Who was appointed successor to St. Clair?	570
Relate Wayne's Exploits.	571
Describe "Little Turtle."	571
Where was a decisive battle fought?	571
What was the character of Wayne?	571
Where did he erect works of Defense?	571
What Expedition did he order?	572
How were his Troops disposed?	572
What tactics did he employ in the Battle?	572
What was the result of this Battle?	572
How did Philadelphia receive the news?	573
Describe the reception given to Wayne.	573
What was General Jackson's crowning Achievement?	573
Describe the battle of Horseshoe Bend.	573
What proportion of Indians were killed?	573
What Advances have been made in the Science of Astronomy?	574
Name some of the great Mathematicians.	574
What were their Triumphs?	574
How was the planet Uranus Discovered?	574
Who first guessed that it was in the Sky?	574
What did Herschel say concerning it?	574
By whom was it found?	574
What has Mathematics done for Astronomy?	574
What aid is derived from Photography?	575
How are Maps of the Sky made?	575
How long does it take to make a picture of the full Moon?	575
Describe the Electric Telescope.	575
What has it done?	575
Who discovered the law of Gravitation?	575
What can you say of the Nebulæ?	575
What is proved by the Spectroscope?	576
What is the Sun?	576
What of the motions of the Heavenly Bodies?	576
What investigations are carried on at Lick Observatory?	576
What is said of the Wise Man and the Fool?	576
What was the saying of Coleridge?	576
What work is required of the Female Peasantry of Europe?	577
What is the capacity of Woman for outdoor work?	577
What were the last words of Cecil Rhodes?	578
What name was given to him?	578
What efforts were made to save his life?	578
What was the character of the man?	578
How did he obtain the title of "Young Contractor"?	578
Describe Cape Town.	579
Describe Rhodes' interest in Education.	579
What was his plan for educating Young Men?	579
What gift did he make to American students?	579
What about the Diamond Mines of South Africa?	579
What mine did he save and develop?	579
How deep in the earth are the diamonds found?	580

QUESTIONS.	ANSWERS. PAGE.
Describe the Transvaal.	580
How long since the Mines were discovered?	580
What is the output of Gold?	580
What number of Mines produce Gold?	580
Give date and place of birth of Elizabeth Ackers Allen.	581
For what poem is she especially famous?	581
Relate history of Hans Christian Andersen.	581
What is the character of his works?	581
For what is George Bancroft distinguished?	582
What can you say of his ability as a Historian?	582
Relate the history of James G. Blaine	583
For what is George H. Boker known?	584
What is Edwin Booth's rank as an actor?	584
Give an account of Rev. Phillips Brooks.	585
What are the characteristies of Elizabeth Barret Browning's writings?	585
What of Robert Browning's?	586
Give a sketch of William Cullen Bryant.	586
Narrate the history of Lord Byron.	587
What was his rank among Poets?	587
What are Thomas Campbell's noted poems?	588
For what is Thomas Carlyle celebrated?	588
Describe the career of Andrew Carnegie.	588
Give an account of Alice and Phœbe Cary.	589
What was Rufus Choate distinguished for?	589
Relate the history of Henry Clay.	589
What is his rank among American Orators?	590
Narrate the career of Grover Cleveland.	590
Name the famous works of George Eliot.	590
Give an account of Chauncey M. Depew.	590
Who is considered the greatest novelist?	591
What do you know about him?	591
Narrate history of Ralph Waldo Emerson.	592
Give an account of James A. Garfield.	592
What position did Gladstone hold among English statesmen?	593
What can you say of John B. Gough?	593
What of Henry Woodfin Grady?	593
Relate the story of General U. S. Grant.	594
Relate the facts in the Life of Benjamin Harrison.	594
For what was Francis Bret Harte noted?	595
What is Nathaniel Hawthorne's rank among authors?	595
What is the character of J. G. Holland's writings?	596
Describe the works of Oliver Wendell Holmes.	596
What do you know of Thomas Hood?	597
For what is Victor Hugo celebrated?	597
Describe the career of "Stonewall" Jackson.	598
What is the history of Abraham Lincoln?	598
What are the famous poems of Henry Wadsworth Longfellow?	599
Describe writings of James Russell Lowell.	600
For what is Lord Macauley celebrated?	601
Narrate the career of William McKinley.	601
Give an account of Dwight L. Moody.	602
What brief poem immortalized John Howard Payne?	602
What poems made Edward Allan Poe famous?	602
What do you know of James Whitcomb Riley?	603
Give an account of the poems of John Godfrey Saxe.	603
What can you say of Thomas De Witt Talmage?	603
What is Alfred Tennyson's rank in literature?	603
What is the character of "Mark Twain's" writings?	604
Give an account of the writings of Harriet Beecher Stowe.	605
What works of Sir Walter Scott made him famous?	604
Give an account of Charles Dudley Warner.	605
What was Daniel Webster's career?	605
Relate the history of Frances E. Willard.	606
Where is Panama located?	i
What is the history of the Panama Canal?	i
Give an account of the French Company	ii
What is the length of the Canal?	ii
What is the estimated time of its completion?	iii
What will be the Benefits of the Enterprise?	iv
What its value in war times?	iv
What is the estimated Cost of the work?	vi
How long a time will it take for ships to pass through?	vii
Describe the Mountains and Rivers.	vii
What port was founded in honor of Columbus?	viii
What was the occasion of the World's Fair at St. Louis?	ix
What effects followed Louisiana Purchase?	ix
Describe the Treaty formed between Napoleon and Jefferson.	x
Describe Tallyrand's hostility.	x
How much money did Congress appropriate for the Purchase?	xi
Describe the transfer of the Territory.	xiii
What is said of Jefferson's Diplomacy?	xiv
By what motives was Napoleon actuated?	xv
What did he say to his Counsellors?	xv